Programme on Man and the Biosphere (MAB)
Programme sur l'homme et la biosphère (MAB)

MAB Information System
Biosphere Reserves
Compilation 4, October 1986

Système d'information du MAB
Réserves de la biosphère
Compilation 4, octobre 1986

Prepared for Unesco by the IUCN Conservation Monitoring Centre
Préparée pour l'Unesco par le Centre de surveillance continue de la conservation de la nature de l'UICN

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A contribution to GEMS - Global Environment Monitoring System

The MAB Information System was established to better manage the operational activities undertaken by nearly 100 countries in Unesco's Man and Biosphere (MAB) Programme. Using specially designed computer systems, it provides continuously updated information on MAB field projects, biosphere reserves and other activities, on the basis of which a variety of tabulations and reports can be made. The information presented is intended to highlight similarities and complementarities between MAB activities which could serve as a basis for eventual link-ups among them, as well as to provide comprehensive listings of scientists participating in the MAB Programme. It is thus hoped that the MAB Information System will facilitate project coordination and the exchange of information and personnel within the framework of MAB. So far, compilations have been issued for the inventory of MAB field research projects ('Blue Series'), for biosphere reserves ('Red Series'), and for research publications (in the journal 'Ecology Abstracts').

For more information, write: MAB Secretariat, UNESCO,
7 Place de Fontenoy, 75700 Paris, FRANCE.

Le Système d'information du MAB a été établi afin de mieux gèrer les activités opérationnelles lancées par une centaine de pays dans le cadre du Programme de l'Unesco sur l'Homme et la biosphère (MAB). Utilisant des systèmes d'informatique spécialement conçus, il fournit des données à jour sur les projets MAB sur le terrain, les réserves de la biosphère et d'autres activités, et permet la préparation de tableaux et de rapports de différentes natures. L'information présentée devrait permettre la mise en relief des similarités et des complémentarités existant entre les activités du MAB, et permettrait le développement éventuel des liens entre ces activités, ainsi que l'établishment des listes aussi complètes que possible des scientifiques participant au Programme MAB. Le Système d'information du MAB devrait alors faciliter la coordination des projets, ainsi que l'échange d'information et de personnel dans le cadre du MAB. Des compilations ont déjà été établies pour les projets MAB sur le terrain ("Série bleue"), pour les Reserves de la biosphere ("Série rouge") et pour la publication des résultats de la recherche (dans la revue "Ecology Abstracts").

Pour tout reseignement, contacter: Secrétariat du MAB,
UNESCO, 7 Place de Fontenoy, 75700 Paris, FRANCE.

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COMPILATION 4 - BIOSPHERE RESERVES

INTRODUCTION (English)

The MAB Information System was established to better manage the operational activities undertaken in more than 100 countries which participate in the Man and the Biosphere (MAB) Programme of Unesco. Using increasingly sophisticated computer systems, it provides continuously updated information on MAB research projects, biosphere reserves, MAB National Committees and the research workers and scientists working on MAB research and training.

Compilation 4 on Biosphere Reserves is the first compilation undertaken since the launching of the Action Plan for Biosphere Reserves at the 8th session of the MAB International Coordinating Council in December 1984. In describing the cooperation function of biosphere reserves, the Action Plan recalls "... that all biopshere reserves are part of an international network, which provides a framework for communication within and amongst biogeographic regions. Cooperation involves the sharing of technology and information, and the development of co-ordinated monitoring and research projects, to better provide information on problems of common interest". Accordingly, under Action 32 of the Action Plan, Unesco has collaborated with the Conservation Monitoring Centre (CMC) of IUCN to develop a system for the collection, storage, synthesis, evaluation and dissemination of information associated with biosphere reserves. Compilation 4 corresponds to a pooling of expertise and information of the two organisations in an attempt to provide a more modern, improved information system to biosphere reserve managers, MAB National Committees and all scientists working in MAB. These persons and institutions are invited to use this Compilation to develop the cooperative function of biosphere reserves, to increase the exchange of information between reserves and hence to build up a truly functioning biosphere reserve network.

In order to help both Unesco and CMC to maintain and update this service, biosphere reserve managers or responsible authorities are requested to complete the biosphere reserve questionnaire in the annex and return them to the MAB Secretariat. Additional information is also very valuable to the Biosphere Reserve Information System. In particular, the MAB Secretariat would greatly appreciate receiving copies (preferably 3) of the following types of information, as outlined in Action 33 of the Action Plan:

(a) publications and audio-visual material relating directly to the biosphere reserve concept;

(b) basic information on the geographical, biological (including species' lists), and social characteristics of each biosphere reserve;

(c) bibliography of scientific literature relating to individual biosphere reserves;

(d) legislative and administrative provisions for biosphere reserves;

(e) the details of management plans;

(f) history of relevant research and monitoring.

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7 Place de Fontenoy
75700 Paris
FRANCE

Telex: 204461 or 270602 Paris

COMPILATION 4 - RESERVES DE LA BIOSPHERE

INTRODUCTION (en français)

Le Système d'information du MAB a été établi afin de mieux gérer les activités opérationnelles lancées dans plus d'une centaine de pays dans le cadre du Programme de l'Unesco sur l'Homme et la biosphère (MAB). Utilisant des systèmes d'informatique sophistiqués, il fournit des données à jour sur les projets MAB, les réserves de la biosphère, les Comités nationaux du MAB et sur les chercheurs et les scientifiques impliqués dans les recherches et la formation du MAB.

La Compilation 4 sur les réserves de la biosphère est la première compilation préparée depuis le lancement du Plan d'Action pour les Réserves de la Biosphère lors de la 8e session du Conseil international de coordination du MAB, en décembre 1984. Le Plan d'action, en décrivant la fonction de coopération des réserves de la biosphère, rappelle que "... toutes les réserves de la biosphère font partie du réseau international qui offre un cadre à la communication tant à l'intérieur des régions biogéographiques qu'entre elles. La coopération à ce niveau consiste à mettre en commun la technologie et l'information et à concevoir des projets coordonnés de surveillance et de recherche afin de mieux comprendre les problèmes d'intérêt commun." Ainsi, conformément à l'Action 32 du Plan d'action, l'Unesco a collaboré avec le Centre de surveillance continue de la conservation de la nature de l'UICN pour développer un système de collecte, de stockage, de synthèse, d'évaluation et de diffusion de l'information relative aux réserves de la biosphère. La Compilation 4 correspond à un effort de mise en commun de l'expertise et des données dont disposent les deux organisations, afin d'offrir un meilleur système d'information, plus moderne, aux Comités nationaux du MAB et aux scientifiques travaillant dans le cadre des projets MAB. Ces personnes et institutions sont invitées à utiliser cette compilation pour développer la fonction de coopération des réserves de la biosphère, pour renforcer les échanges d'information entre réserves et établir ainsi un véritable réseau opérationnel de réserves de la biosphère.

Afin d'assister l'Unesco et l'UICN dans le maintien et la mise à jour de ce système, les personnes ou les autorités responsables des réserves de la biosphère sont invitées à compléter le questionnaire se trouvant en annexe et à le retourner au Secrétariat du MAB. Toute information supplémentaire sera également très utile pour améliorer le Système d'information sur les réserves de la biosphère. En particulier, le Secrétariat du MAB souhaite recevoir des copies (trois de préférence) des différents types d'information énumérés ci-dessous et décrits dans l'Action 33 du Plan d'action:

(a) publications et matériel audiovisuel directement liés à la notion de réserves de la biosphère;

(b) information de base sur les caractéristiques géographiques, biologiques (notamment listes d'espèces) et sociales de chaque réserve de la biosphère;

(c) bibliographie des publications scientifiques concernant des réserves de la biosphère déterminées;

(d) dispositions législatives et administratives relatives aux réserves de la biosphère;

(e) contenu détaillé des plans d'aménagement;

(f) historique des activités pertinentes de recherche et de surveillance.

Adresse pour toute correspondance: Secrétariat du MAB
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75700 Paris
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List of Biosphere Reserves
Liste des reserves de la biosphere

ALLEMAGNE, REPUBLIQUE FEDERALE D'
Voir paragraphe Germany, Federal Republic of

ARGENTINA/ARGENTINE			
Reserva de la Biosfera "San Guillermo"	8.37.12	981,460	1980
Reserva Natural de Vida Silvestre "Laguna Blanca"	8.25.07	981,620	1982
Parque Costero del Sur	8.31.11	30,000	1984
Reserva Ecologica de Nacunan	8.25.07	11,900	1986
AUSTRALIA/AUSTRALIE			
Croajingolong	6.06.06	101,000	1977
Danggali Conservation Park	6.10.07	253,230	1977
Kosciusko National Park	6.06.06	625,525	1977
Macquarie Island Nature Reserve	7.04.09	12,785	1977
Prince Regent River Nature Reserve	6.03.04	633,825	1977
Southwest National Park	6.02.02	403,240	1977
The Unnamed Conservation Park of South Australia	6.09.07	2,132,600	1977
Uluru (Ayers Rock-Mount Olga) National Park	6.09.07	132,550	1977
Yathong Nature Reserve	6.13.11	107,241	1977
Fitzgerald River National Park	6.04.06	242,727	1978
Hattah-Kulkyne NP & Murray-Kulkyne Park	6.05.06	49,500	1981
Wilson's Promontory National Park	6.06.06	49,000	1981
AUSTRIA/AUTRICHE			
Gossenkollesee	2.32.12	100	1977
Gurgler Kamm	2.32.12	1,500	1977
Lobau Reserve	2.32.12	1,000	1977
Neusiedler See-Osterreichischer Teil	2.12.05	25,000	1977

BIELORUSSIE REPUBLIQUE SOCIALISTE SOVIETIQUE
Voir paragraphe Byelorussian Soviet Socialist Republic

BENIN			
Reserva de la biosphere de la Pendjari	3.04.04	880,000	1986
BOLIVIA/BOLIVIE			
Parque Nacional Pilon-Lajas	8.06.01	100,000	1977
Reserva Nacional de Fauna "Ulla Ulla"	8.36.12	200,000	1977
BULGARIA/BULGARIE			
Parc national Steneto	2.33.12	2,889	1977
Réserve Alibotouch	2.33.12	1,628	1977
Réserve Bistrichko Branichté	2.33.12	1,177	1977
Réserve Boatine	2.33.12	1,281	1977
Réserve Djendema	2.33.12	1,775	1977
Réserve Doupkata	2.33.12	1,210	1977
Réserve Doupki-Djindjiritza	2.33.12	2,873	1977
Réserve Kamtchia	2.33.12	842	1977
Réserve Koupena	2.33.12	1,084	1977
Réserve Mantaritza	2.33.12	576	1977
Réserve Maritchini ezera	2.33.12	1,510	1977
Réserve Ouzounboudjak	2.33.12	2,575	1977

Réserve Parangalitza	2.33.12	1,509	1977
Réserve Srebarna	2.11.05	600	1977
Réserve Tchervenata stena	2.33.12	812	1977
Réserve Tchoupréné	2.33.12	1,440	1977
Réserve Tsaritchina	2.33.12	1,420	1977
BYELORUSSIAN SOVIET SOCIALIST REPUBLIC			
Berezinskiy Zapovednik	2.10.05	76,201	1978
CAMEROON, UNITED REPUBLIC OF			
Parc national de Waza	3.04.04	170,000	1979
Parc national de la Benoue	3.04.04	180,000	1981
Réserve forestière et de faune du Dja	3.02.01	500,000	1981
CANADA			
Mont St Hilaire	1.05.05	5,550	1978
Waterton Lakes National Park	1.19.12	52,597	1979
Long Point Biosphere Reserve	1.22.14	27,000	1986
Riding Mountain Biosphere Reserve	1.04.03	297,591	1986
CENTRAL AFRICAN REPUBLIC			
Basse-Lobaye Forest	3.02.01	18,200	1977
Bamingui-Bangoran Conservation Area	3.04.04	1,622,000	1979
CHILE/CHILI			
Parque Nacional Fray Jorge	8.23.06	14,074	1977
Parque Nacional Juan Fernandez	5.04.13	9,290	1977
Parque Nacional Torres del Paine	8.37.12	184,414	1978
Parque Nacional Laguna San Rafael	8.11.02	1,742,448	1979
Parque Nacional Lauca	8.36.12	358,312	1981
Reserva de la Biosfera 'Araucarias'	8.22.05	81,000	1983
Reserva de la Biosfera La Campana - Penuelas	8.23.06	17,095	1984
CHINA/CHINE			
Changbai Mountain Nature Reserve	2.14.05	217,235	1979
Dinghu Nature Reserve	4.06.01	1,200	1979
Wolong Nature Reserve	2.39.12	207,210	1979
COLOMBIA/COLOMBIE			
Cinturon Andino Cluster Biosphere Reserve	8.33.12	855,000	1979
El Tuparro Nature Reserve	8.27.10	928,125	1979
Sierra Nevada de Santa Marta (incl. Tayrona NP)	8.17.04	731,250	1979
CONGO			
Parc national d'Odzala	3.02.01	110,000	1977
COSTA RICA			
Reserva de la Biosfera de la Amistad	8.16.04	500,000	1982
COTE D'IVOIRE			
Parc national de Taï	3.01.01	330,000	1977
Parc national de la Comoe	3.04.04	1,150,000	1983
CUBA			
Sierra del Rosario	8.39.13	10,000	1984

CZECHOSLOVAKIA			
Krivoklatsko Protected Landscape Area	2.11.05	62,792	1977
Slovensky Kras Protected Landscape Area	2.11.05	36,165	1977
Trebon Basin Protected Landscape Area	2.11.05	70,000	1977
Palava Protected Landscape Area	2.11.05	8,017	1986
DENMARK/DANEMARK			
Northeast Greenland National Park	1.17.09	70,000,000	1977
ECUADOR			
Archipielago de Colon (Galapagos)	8.44.13	766,514	1984
EGYPT/EGYPTE			
Omayed Experimental Research Area	2.18.07	1,000	1981
EQUATEUR			
Voir paragraphe Ecuador			
ESPAGNE			
Voir paragraphe Spain			
ETATS-UNIS D'AMERIQUE			
Voir paragraphe United States of America			
FRANCE			
Atoll de Taiaro	5.04.13	2,000	1977
Forêt domaniale du Fango	2.17.06	6,410	1977
Réserve nationale de Camargue BR	2.17.06	13,117	1977
Réserve de la biosphere du PN des Cévennes	2.09.05	323,000	1984
GABON			
Réserve naturelle integrale d'Ipassa-Makokou	3.02.01	15,000	1983
GERMAN DEMOCRATIC REPUBLIC			
Steckby-Loedderitz Forest Nature Reserve	2.11.05	3,500	1979
Vessertal Nature Reserve	2.11.05	1,384	1979
GERMANY, FEDERAL REPUBLIC OF			
Bayerischer Wald National Park	2.32.12	13,100	1981
GHANA			
Bia National Park	3.01.01	7,770	1983
GREECE/GRECE			
Gorge of Samaria National Park	2.17.06	4,840	1981
Mount Olympus National Park	2.17.06	4,000	1981
GUINEA/GUINEE			
Réserve de la biosphere des Monts Nimba	3.01.01	17,130	1980
Réserve de la biosphere du Massif du Ziama	3.01.01	116,170	1980
HONDURAS			
Rio Platano Biosphere Reserve	8.16.04	500,000	1980

HUNGARY/HONGRIE			
Biosphere Reserve of Aggtelek	2.11.05	19,247	1979
Hortobagy National Park	2.12.05	52,000	1979
Kiskunsag Biosphere Reserve	2.12.05	22,095	1979
Lake Fertő Biosphere Reserve	2.12.05	12,542	1979
Pilis Biosphere Reserve	2.11.05	23,000	1980
ILE MAURICE			
Voir paragraphe Mauritius			
INDONESIA/INDONESIE			
Cibodas Biosphere Reserve (Gunung Gede-Pangrango)	4.22.13	140,000	1977
Komodo Proposed National Park	4.23.13	30,000	1977
Lore Lindu Proposed National Park	4.24.13	231,000	1977
Tanjung Puting Proposed National Park	4.25.13	205,000	1977
Gunung Leuser Proposed National Park	4.21.13	946,400	1981
Siberut Nature Reserve	4.21.13	56,000	1981
IRAN			
Arasbaran Protected Area	2.34.12	52,000	1976
Arjan Protected Area	2.34.12	65,750	1976
Geno Protected Area	2.20.08	49,000	1976
Golestan National Park	2.34.12	125,895	1976
Hara Protected Area	2.20.08	85,686	1976
Kavir National Park	2.24.08	700,000	1976
Lake Oromeeh National Park	2.34.12	462,600	1976
Miankaleh Protected Area	2.34.12	68,800	1976
Touran Protected Area	2.24.08	1,000,000	1976
IRELAND/IRELANDE			
North Bull Island	2.08.05	500	1981
Killarney National Park	2.08.05	8,308	1982
ITALY/ITALIE			
Collemeluccio-Montedimezzo	2.32.12	478	1977
Foret Domaniale du Circeo	2.17.06	3,260	1977
Miramare Marine Park	2.17.06	60	1979
JAPAN/JAPON			
Mount Hakusan	2.02.02	48,000	1980
Mount Odaigahara & Mount Omine	2.02.02	36,000	1980
Shiga Highland	2.15.05	13,000	1980
Yakushima Island	2.02.02	19,000	1980
KENYA			
Mount Kenya Biosphere Reserve	3.21.12	71,759	1978
Mount Kulal Biosphere Reserve	3.14.07	700,000	1978
Malindi-Watamu Biosphere Reserve	3.14.07	19,600	1979
Kiunga Marine National Reserve	3.14.07	60,000	1980
KOREA, REPUBLIC OF			
Mount Sorak Biosphere Reserve	2.15.05	37,430	1982
MALI			
Parc national de la Boucle du Baoulé (etc)	3.04.04	771,000	1982

MAURITIUS			
Macchabee/Bel Ombre Nature Reserve	3.25.13	3,594	1977
MEXICO/MEXIQUE			
Reserva de Mapimi	1.09.07	100,000	1977
Reserva de la Michilia	1.21.12	42,000	1977
Montes Azules	8.01.01	331,200	1979
NIGERIA			
Omo Strict Natural Reserve	3.01.01	460	1977
NORWAY/NORVEGE			
Northeast Svalbard Nature Reserve	2.25.09	1,555,000	1976
OUGANDA			
Voir paragraphe Uganda			
PAKISTAN			
Lal Suhanra National Park	4.15.07	31,355	1977
PANAMA			
Parque Nacional Fronterizo Darien	8.02.01	597,000	1983
PERU/PEROU			
Reserva de Huascaran	8.37.12	399,239	1977
Reserva del Manu	8.05.01	1,881,200	1977
Reserva del Noroeste	8.19.04	226,300	1977
PHILIPPINES			
Puerto Galera Biosphere Reserve	4.26.13	23,545	1977
POLAND/POLOGNE			
Babia Gora National Park	2.11.05	1,741	1976
Bialowieza National Park	2.10.05	5,316	1976
Lukajno Lake Reserve	2.10.05	710	1976
Slowinski National Park	2.11.05	18,069	1976
PORTUGAL			
Paul do Boquilobo Biosphere Reserve	2.17.06	395	1981
REPUBLIQUE CENTRAFRICAINE			
Voir paragraphe Central African Republic			
REPUBLIQUE DE COREE			
Voir paragraphe Korea, Republic of			
REPUBLIQUE DEMOCRATIQUE D'ALLEMAGNE			
Voir paragraphe German Democratic Republic			
REPUBLIQUE-UNIE DU CAMEROUN			
Voir paragraphe Cameroon			
REPUBLIQUE-UNIE DU TANZANIE			
Voir paragraphe Tanzania, United Republic of			

ROMANIA/ROUMANIE			
Pietrosul Mare Nature Reserve	2.11.05	3,068	1979
Retezat National Park	2.11.05	20,000	1979
Rosca-Letea Reserve	2.29.11	18,145	1979
ROYAUME-UNI			
Voir paragraphe United Kingdom			
RWANDA			
Parc national des Volcans	3.20.12	15,065	1983
SENEGAL			
Forêt classée de Samba Dia	3.04.04	756	1979
Delta du Saloum	3.04.04	180,000	1980
Parc national du Niokolo-Koba	3.04.04	913,000	1981
SPAIN			
Reserva de Grazalema	2.17.06	32,210	1977
Reserva de Ordesa-Vinamala	2.16.06	51,396	1977
Parque Natural del Montseny	2.17.06	17,372	1978
Reserva de la Biosfera de Donana	2.17.06	77,260	1980
Reserva de la Biosfera de la Mancha Humeda	2.17.06	25,000	1980
Las Sierras de Cazorla y Segura BR	2.17.06	190,000	1983
Reserva de la Biosfera de las Marismas del Odiel	2.17.06	8,728	1983
Reserva de la Biosfera del Canal y los Tiles	2.40.13	511	1983
Reserva de la Biosfera del Urdaibai	2.16.06	22,500	1984
Reserva de la Biosfera "Sierra Nevada"	2.17.06	190,000	1986
SRI LANKA			
Hurulu Forest Reserve	4.13.04	512	1977
Sinharaja Forest Reserve	4.02.01	8,864	1978
SUDAN/SOUDAN			
Dinder National Park	3.13.07	650,000	1979
Radom National Park	3.05.04	1,250,970	1979
SWITZERLAND/SUISSE			
Parc national Suisse	2.32.12	16,870	1979
TANZANIA, UNITED REPUBLIC OF			
Lake Manyara National Park	3.05.04	32,500	1981
Serengeti National Park	3.05.04	2,305,100	1981
TCHECOSLOVAKIA			
Voir paragraphe Czechoslovakia			
THAILAND/THAILANDE			
Sakaerat Environmental Research Station	4.10.04	7,200	1976
Hauy Tak Teak Reserve	4.10.04	4,700	1977
Mae Sa-Kog Ma Reserve	4.10.04	14,200	1977
TUNISIA/TUNISIE			
Parc national de Djebel Bou-Hedma	2.28.11	11,625	1977
Parc national de Djebel Chambi	2.28.11	6,000	1977
Parc national de l'Ichkeul	2.17.06	10,770	1977
Parc national des Iles Zembra et Zembretta	2.17.06	4,030	1977

UGANDA			
Queen Elizabeth (Rwenzori) National Park	3.05.04	220,000	1979
UKRAINIAN SOVIET SOCIALIST REPUBLIC/UKRAINE			
Chernomorskiy Zapovednik	2.29.11	87,348	1984
Askaniya-Nova Zapovednik	2.29.11	33,307	1985
UNION OF SOVIET SOCIALIST REPUBLICS/ UNION DES REPUBLIQUES SOCIALISTES SOVIETIQUES			
Chatkal Mountains Biosphere Reserve	2.36.12	71,400	1978
Kavkazskiy Zapovednik	2.34.12	263,477	1978
Oka River Valley Biosphere Reserve	2.10.05	45,845	1978
Repetek Zapovednik	2.21.08	34,600	1978
Sikhote-Alin Zapovednik	2.14.05	340,200	1978
Tsentral'nochernozem Zapovednik	2.10.05	4,795	1978
Astrakhanskiy Zapovednik	2.21.08	63,400	1984
Kronotskiy Zapovednik	2.07.05	1,099,000	1984
Laplandskiy Zapovednik	2.03.03	278,400	1984
Pechoro-Ilychskiy Zapovednik	2.03.03	721,322	1984
Sayano-Shushenskiy Zapovednik	2.35.12	389,570	1984
Sokhondinskiy Zapovednik	2.30.11	211,000	1984
Voronezhskiy Zapovednik	2.11.05	31,053	1984
Tsentral'nolesnoy Zapovednik	2.10.05	21,348	1985
Lake Baikal Region Biosphere Reserve	2.04.03	559,100	1986
UNITED KINGDOM			
Beinn Eighe National Nature Reserve	2.31.12	4,800	1976
Braunton Burrows National Nature Reserve	2.08.05	596	1976
Caerlaverock National Nature Reserve	2.08.05	5,501	1976
Cairnsmore of Fleet National Nature Reserve	2.08.05	1,922	1976
Dyfi National Nature Reserve	2.08.05	1,589	1976
Isle of Rhum National Nature Reserve	2.31.12	10,560	1976
Loch Druidibeg National Nature Reserve	2.31.12	1,658	1976
Moor House-Upper Teesdale Biosphere Reserve	2.08.05	7,399	1976
North Norfolk Coast Biosphere Reserve	2.08.05	5,497	1976
Silver Flowe-Merrick Kells Biosphere Reserve	2.08.05	3,088	1976
St Kilda National Nature Reserve	2.08.05	842	1976
Claish Moss National Nature Reserve	2.31.12	480	1977
Taynish National Nature Reserve	2.31.12	326	1977
UNITED STATES OF AMERICA			
Aleutian Islands National Wildlife Refuge	1.12.09	1,100,943	1976
Big Bend National Park	1.09.07	283,247	1976
Cascade Head Expt. Forest & Scenic Research Area	1.02.02	7,051	1976
Central Plains Experimental Range (CPER)	1.18.11	6,210	1976
Channel Islands Biosphere Reserve	1.07.06	479,652	1976
Coram Experimental Forest (incl. Coram NA)	1.19.12	3,019	1976
Coweeta Hydrologic Laboratory	1.05.05	2,185	1976
Denali National Park and Biosphere Reserve	1.03.03	2,441,295	1976
Desert Experimental Range	1.11.08	22,513	1976
Everglades National Park (incl. Ft. Jefferson NM)	8.12.04	585,867	1976
Fraser Experimental Forest	1.19.12	9,328	1976
Glacier National Park	1.19.12	410,202	1976
Great Smoky Mountains National Park	1.05.05	209,000	1976
H.J. Andrews Experimental Forest	1.20.12	6,100	1976
Hubbard Brook Experimental Forest	1.05.05	3,076	1976

Jornada Experimental Range	1.09.07	78,297	1976
Luquillo Experimental Forest (Caribbean NF)	8.40.13	11,340	1976
Noatak National Arctic Range	1.13.09	3,035,200	1976
Olympic National Park	1.02.02	363,379	1976
Organ Pipe Cactus National Monument	1.08.07	133,278	1976
Rocky Mountain National Park	1.19.12	106,710	1976
San Dimas Experimental Forest	1.07.06	6,947	1976
San Joaquin Experimental Range	1.07.06	1,832	1976
Sequoia-Kings Canyon National Parks	1.20.12	343,000	1976
Stanislaus-Tuolumne Experimental Forest	1.20.12	607	1976
Three Sisters Wilderness	1.20.12	80,900	1976
Virgin Islands National Park & Biosphere Reserve	8.41.13	6,127	1976
Yellowstone National Park	1.19.12	898,349	1976
Beaver Creek Experimental Watershed	1.08.07	111,300	1978
Konza Prairie Research Natural Area	1.18.11	3,487	1979
Niwot Ridge Biosphere Reserve	1.19.12	1,200	1979
The University of Michigan Biological Station	1.18.11	4,048	1979
The Virginia Coast Reserve	1.05.05	13,511	1979
Hawaii Islands Biosphere Reserve	5.03.13	99,545	1980
Isle Royale National Park	1.22.14	215,740	1980
Big Thicket National Preserve	1.06.05	34,217	1981
Guanica Commonwealth Forest Reserve	8.40.13	4,006	1981
California Coast Ranges Biosphere Reserve	1.02.02	62,098	1983
Central Gulf Coastal Plain Biosphere Reserve	1.06.05	72,964	1983
South Atlantic Coastal Plain BR	1.5/6.05	444,335	1983
Mojave and Colorado Deserts Biosphere Reserve	1.08.07	1,297,264	1984
Carolinian-South Atlantic Biopshere Reserve	1.06.05	118,463	1986
Glacier Bay-Admiralty Island Biosphere Reserve	1.01.02	1,515,015	1986
URUGUAY			
Banados del Este	8.32.11	200,000	1976
YUGOSLAVIA/YUGOSLAVIE			
Reserve Ecologique du Bassin de la Riviere Tara	2.33.12	200,000	1976
The Velebit Mountain	2.17.06	150,000	1977
ZAIRE			
Reserve Floristique de Yangambi	3.02.01	250,000	1976
Forest Reserve of Luki	3.02.01	33,000	1979
Vallee de la Lufira	3.06.04	14,700	1982

Summary of Biosphere Reserve coverage by biogeographical province

(After Udvardy, 1975)

		Number of areas	Total area (hectares)
Nearctic Realm			
1	Sitkan	1	1,515,015
2	Oregonian	3	432,528
3	Yukon Taiga	1	2,441,295
4	Canadian Taiga	1	297,591
5	Eastern Forest	5 (+part)	671,532
6	Austroriparian	3 (+part)	231,769
7	Californian	3	488,431
8	Sonoran	3	1,541,842
9	Chihuahuan	3	461,544
10	Tamaulipan		No areas listed
11	Great Basin	1	22,513
12	Aleutian Islands	1	1,100,943
13	Alaskan Tundra	1	3,035,200
14	Canadian Tundra		No areas listed
15	Arctic Archipelago		No areas listed
16	Greenland Tundra		No areas listed
17	Arctic Desert and Icecap	1	70,000,000
18	Grasslands	3	13,745
19	Rocky Mountains	7	1,481,405
20	Sierra-Cascade	4	430,607
21	Madrean-Cordilleran	1	42,000
22	Great Lakes	2	242,740

A total of 45 reserves covering 84,450,700 hectares

Palaearctic Realm			
1	Chinese Subtropical Forest		No areas listed
2	Japanese Evergreen Forest	3	103,000
3	West Eurasian Taiga	2	999,722
4	East Siberian Taiga	1	559,100
5	Icelandian		No areas listed
6	Subarctic Birchwoods		No areas listed
7	Kamchatkan	1	1,099,000
8	British Islands	10	35,242
9	Atlantic	1	323,000
10	Boreonemoral	6	154,215
11	Middle European Forest	14	298,636
12	Pannonian	4	111,637
13	West Anatolian		No areas listed
14	Manchu-Japanese Mixed Forest	2	557,435
15	Oriental Deciduous Forest	2	50,430
16	Iberian Highlands	2	73,896
17	Mediterranean Sclerophyll	17	737,452
18	Sahara	1	1,000
19	Arabian Desert		No areas listed
20	Anatolian-Iranian Desert	2	134,686

21	Turanian	2	98,000
22	Takla-Makan-Gobi Desert		No areas listed
23	Tibetan		No areas listed
24	Iranian Desert	2	1,700,000
25	Arctic Desert	1	1,555,000
26	Higharctic Tundra		No areas listed
27	Lowarctic Tundra		No areas listed
28	Atlas Steppe	2	17,625
29	Pontian Steppe	3	138,800
30	Mongolian-Manchurian Steppe	1	211,000
31	Scottish Highlands	5	17,824
32	Central European Highlands	6	33,048
33	Balkan Highlands	17	224,601
34	Caucaso-Iranian Highlands	6	1,038,522
35	Altai Highlands	1	389,570
36	Pamir-Tian-Shan Highlands	1	71,400
37	Hindu Kush Highlands		No areas listed
38	Himalayan Highlands		No areas listed
39	Szechwan Highlands	1	207,210
40	Macaronesian Islands	1	511
41	Ryukyu Islands		No areas listed
42	Lake Ladoga		No areas listed
43	Aral Sea		No areas listed
44	Lake Baikal		No areas listed

A total of 117 reserves covering 10,941,562 hectares

Afrotropical Realm

1	Guinean Rain Forest	5	471,530
2	Congo Rain Forest	6	926,200
3	Malagasy Rain Forest		No areas listed
4	West African Woodland/Savanna	9	5,866,756
5	East African Woodland/Savanna	4	3,808,570
6	Congo Woodland/Savanna	1	14,700
7	Miombo Woodland/Savanna		No areas listed
8	South African Woodland/Savanna		No areas listed
9	Malagasy Woodland/Savanna		No areas listed
10	Malagasy Thorn Forest		No areas listed
11	Cape Sclerophyll		No areas listed
12	Western Sahel		No areas listed
13	Eastern Sahel	1	650,000
14	Somalian	3	779,600
15	Namib		No areas listed
16	Kalahari		No areas listed
17	Karroo		No areas listed
18	Ethiopian Highlands		No areas listed
19	Guinean Highlands		No areas listed
20	Central African Highlands	1	15,065
21	East African Highlands	1	71,759
22	South African Highlands		No areas listed
23	Ascension and St Helena Islands		No areas listed
24	Comores Islands and Aldabra		No areas listed
25	Mascarene Islands	1	3,594
26	Lake Rudolf		No areas listed

27	Lake Ukerewe (Victoria)		No areas listed
28	Lake Tanganyika		No areas listed
29	Lake Malawi (Nyasa)		No areas listed

A total of 32 reserves covering 12,607,774 hectares

Indomalayan Realm

1	Malabar Rainforest		No areas listed
2	Ceylonese Rainforest	1	8,864
3	Bengalian Rainforest		No areas listed
4	Burman Rainforest		No areas listed
5	Indochinese Rainforest		No areas listed
6	South Chinese Rainforest	1	1,200
7	Malayan Rainforest		No areas listed
8	Indus-Ganges Monsoon Forest		No areas listed
9	Burma Monsoon Forest		No areas listed
10	Thailandian Monsoon Forest	3	26,100
11	Mahanadian		No areas listed
12	Coromandel		No areas listed
13	Ceylonese Monsoon Forest	1	512
14	Deccan Thorn Forest		No areas listed
15	Thar Desert	1	31,355
16	Seychelles and Amirantes Islands		No areas listed
17	Laccadives Islands		No areas listed
18	Maldives and Chagos Islands		No areas listed
19	Cocos-Keeling and Christmas Islands		No areas listed
20	Andaman and Nicobar Islands		No areas listed
21	Sumatra	2	1,002,400
22	Java	1	140,000
23	Lesser Sunda Islands	1	30,000
24	Sulawesi (Celebes)	1	231,000
25	Borneo	1	205,000
26	Philippines	1	23,545
27	Taiwan		No areas listed

A total of 14 reserves covering 1,699,976 hectares

Oceanian Realm

1	Papuan		No areas listed
2	Micronesian		No areas listed
3	Hawaiian	1	99,545
4	Southeastern Polynesian	2	11,290
5	Central Polynesian		No areas listed
6	New Caledonian		No areas listed
7	East Melanesian		No areas listed

A total of 3 reserves covering 110,835 hectares

Australian Realm

1	Queensland Coastal		No areas listed
2	Tasmanian	1	403,240
3	Northern Coastal	1	633,825
4	Western Sclerophyll	1	242,727

5	Southern Sclerophyll	1	49,500
6	Eastern Sclerophyll	3	775,525
7	Brigalow		No areas listed
8	Western Mulga		No areas listed
9	Central Desert	2	2,265,150
10	Southern Mulga/Saltbush	1	253,230
11	Northern Savanna		No areas listed
12	Northern Grasslands		No areas listed
13	Eastern Grasslands and Savannas	1	107,241

A total of 11 reserves covering 4,730,438 hectares

Antarctic Realm

1	Neozealandia		No areas listed
2	Maudlandia		No areas listed
3	Marielandia		No areas listed
4	Insulantarctica	1	12,785

A single reserve of 12,785 hectares

Neotropical Realm

1	Campechean	1	331,200
2	Panamanian	1	597,000
3	Colombian Coastal		No areas listed
4	Guyanan		No areas listed
5	Amazonian	1	1,881,200
6	Madeiran	1	100,000
7	Serro Do Mar		No areas listed
8	Brazilian Rain Forest		No areas listed
9	Brazilian Planalto		No areas listed
10	Valdivian Forest		No areas listed
11	Chilean Nothofagus	1	1,742,448
12	Everglades	1	585,867
13	Sinaloan		No areas listed
14	Guerreran		No areas listed
15	Yucatecan		No areas listed
16	Central American	2	1,000,000
17	Venezuelan Dry Forest	1	731,250
18	Venezuelan Deciduous Forest		No areas listed
19	Equadorian Dry Forest	1	226,300
20	Caatinga		No areas listed
21	Gran Chaco		No areas listed
22	Chilean Araucaria Forest	1	81,000
23	Chilean Sclerophyll	2	31,169
24	Pacific Desert		No areas listed
25	Monte	2	993,520
26	Patagonian		No areas listed
27	Llanos	1	928,125
28	Campos Limpos		No areas listed
29	Babacu		No areas listed
30	Campos Cerrados		No areas listed
31	Argentinian Pampas	1	30,000
32	Uruguayan Pampas	1	200,000
33	Northern Andean	1	855,000

34	Colombian Montane		No areas listed
35	Yungas		No areas listed
36	Puna	2	558,312
37	Southern Andean	3	1,565,113
38	Bahamas-Bermudean		No areas listed
39	Cuban	1	10,000
40	Greater Antillean	2	15,346
41	Lesser Antillean	1	6,127
42	Revilla Gigedo Island		No areas listed
43	Cocos Island		No areas listed
44	Galapagos Islands	1	766,514
45	Fernando De Noronja Island		No areas listed
46	South Trinidade Island		No areas listed
47	Lake Titicaca		No areas listed

A total of 29 reserves covering 13,235,491 hectares

Giving a grand total of 252 reserves covering 127,789,561 hectares

Summary of Biosphere Reserve coverage by biome type

(After Udvardy, 1975)

Tropical humid forests		
Afrotropical	11	1,397,730
Indomalayan	2	10,064
Australian		No areas listed
Neotropical	4	2,909,400
	17	4,317,194
Temperate needle-leaf forests/woodlands		
Nearctic	2	2,738,886
Palaearctic	3	1,558,822
	5	4,297,708
Temperate broad-leaf forests		
Nearctic	9	903,301
Palaearctic	40	2,629,595
Neotropical	1	81,000
	50	3,613,896
Warm deserts/semi-deserts		
Nearctic	6	2,003,386
Palaearctic	1	1,000
Afrotropical	4	1,429,600
Indomalayan	1	31,355
Australian	3	2,518,380
Neotropical	2	993,520
	17	6,977,241
Tundra communities		
Nearctic	3	74,136,143
Palaearctic	1	1,555,000
Antarctic	1	12,785
	5	75,703,928
Temperate grasslands		
Nearctic	3	13,745
Palaearctic	6	367,425
Australian	1	107,241
Neotropical	2	230,000
	12	718,411
Mixed island systems		
Palaearctic	1	511
Afrotropical	1	3,594
Indomalayan	7	1,631,945
Oceanian	3	110,835
Neotropical	5	797,987
	17	2,418,872
Subtropical/temperate rainforests/woodlands		
Nearctic	4	1,947,543
Palaearctic	3	103,000
Australian	1	403,240
Antarctic		No areas listed
Neotropical	1	1,742,448
	9	4,196,231
Tropical dry forests/woodlands		
Afrotropical	14	9,690,026
Indomalayan	4	26,612
Australian	1	633,825
Neotropical	5	2,543,417
	24	12,893,880
Evergreen sclerophyllous forests		
Nearctic	3	488,431
Palaearctic	19	811,348
Afrotropical		No areas listed
Australian	5	1,067,752
Neotropical	2	31,169
	29	2,398,700
Cold-winter deserts		
Nearctic	1	22,513
Palaearctic	6	1,932,686
Neotropical		No areas listed
	7	1,955,199
Tropical grasslands/savannas		
Australian		No areas listed
Neotropical	1	928,125
	1	928,125
Mixed mountain systems		
Nearctic	12	1,954,012
Palaearctic	37	1,982,175
Afrotropical	2	86,824
Neotropical	6	2,978,425
	57	7,001,436
Lake systems		
Nearctic	2	242,740
Palaearctic		No areas listed
Afrotropical		No areas listed
Neotropical		No areas listed
	2	242,740

A total of 252 sites covering 127,789,561 hectares

Reserva de la Biosphera "San Guillermo"

BIOGEOGRAPHICAL PROVINCE 8.37.12/8.25.07 (Southern Andean and Monte)

LEGAL PROTECTION Total

DATE ESTABLISHED Province of San Juan decree 2,164 of 22 June 1972, decree 1,302 of 13 April 1973 and decree 3,376 of 1976. Accepted as a Biosphere Reserve in November 1980.

GEOGRAPHICAL LOCATION Located in the northern part of western Argentina in the Andes mountains in San Juan province. On the Cordillera de San Guillermo. 29°10'S, 69°20'W.

ALTITUDE 2,100-5,800m

AREA 981,460ha

LAND TENURE Private and State property. Private land is currently being expropriated to become property of San Juan Province.

PHYSICAL FEATURES Mountainous region, part of the Andes, formed at the end of the Tertiary and early Quaternary eras with rocks consisting of volcanic strata dating from this period. Carboniferous and coarse grained metamorphic rocks from the Permian era. Geomorphologically, the relief is immature, with intense downcutting by rivers. There are no permanent surface watercourses. Climate is temperate in the foothills to the east with mean annual temperature of 5°C and mean annual rainfall 100-200mm. In the higher western areas the mean annual temperature is -5°C and mean annual rainfall 400-500mm with snow.

VEGETATION Vegetation varies with aspect and altitude: sub-desertic open matorral, open shrub matorral, low grassland with or without shrubs and lichen tundra. Typical vegetation is open canopy of low-growing cushion shrubs including Adesmia nanoliguea, Calceolaria pinifolia and Tephrocactus spp., leaving much exposed ground with coarse grasses. Other shrub species include Patrastrephia spp., Fabiana spp., Azorella spp. and Ephedra spp.. Herbaceous species include Astragalus spp., Tropoelum spp., Glandularia spp., Phacelia spp., Stipa spp., Festuca spp. and Deyeuxia spp.. Grassy steppes occur in the best conditions of soil and humidity especially above 3,500m.

FAUNA Protection of the vicuna Vicugna vicugna (V) is the main reason for the creation of this reserve with the presence of many herds due to the isolation and shortage of water which has limited hunting. The vicuna population is probably a sub-species found nowhere else in South America. Guanaco Lama guanicoe is also present in sizeable herds. Other mammals include fox, rodents such as mountain viscachas Lagidium viscacia and chinchilla Chinchilla brevicaudata and mountain lion Felis concolor. Birds include Andean Condor Vultur gryphus, lesser rhea Pteroicnemia pennata, wild geese and ducks (Anatidae).

ZONING/CONSERVATION MANAGEMENT Core zone of 42,000ha with strict protection has been implemented in the most representative area which is relatively inaccessible and undisturbed by human activities. The remaining 939,000ha constitutes the buffer zone.

STAFF Total of 18 staff including one administrator, two technicians, eight rangers and one driver.

LOCAL ADMINISTRATION Subsecretaria de Agricultura y Ganaderia de San Juan, Ignacio de La Rosa y Aberastain, Edificio 9 de Julio 3erpiso, 5400 San Juan, Republica Argentina.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Global survey with map scale of 1:250,000. Ecological survey of a pilot area at scale of 1:50,000. Main research has been on camelid and rhea populations and guanaco behaviour. Seven research staff. Buildings for accommodation and research are being constructed.

MODIFICATION OF THE NATURAL ENVIRONMENT The area was grazed by cattle, sheep and horses until 30 years ago. Mining activities are reduced to one mine at present. There is some poaching and wood cutting for fuel. There are no permanent residents in or around the reserve.

PRINCIPAL REFERENCE MATERIAL

Cajal, J.L. (1979). Estructura social y area de accion del guanaco Lama guanicoe en la Reserva de San Guillermo, provincia de San Juan. III Cong. Int. sobre Camélidos Sudamericanos. VIEDMA, Rio Negro 11 al 16 de noviembre.

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Cajal, J.L. and Sanchez, E. (1979). Marcha de los censos en vicuna Vicugna vicugna, guanaco Lama guanicoe y nandu cordillerano Pterocnemia pennata en la Reserva de San Guillermo, prov. de San Juan. III Congr. Int. sobre Camélidos Sudamericanos. VIEDMA, Rio Negro, 11 al 16 de noviembre.

Merino de Cuezzo, S.E. (1985). Areas Naturales Protegidas de la Argentina. Secretaria dé Agricultura y Ganaderia, Direccion Nacional de Fauna Silvestre. (Unpublished)

Reserva Natural de Vida Silvestre "Laguna Blanca"

BIOGEOGRAPHICAL PROVINCE 8.25.07 (Monte)

LEGAL PROTECTION Partial

DATE ESTABLISHED 16 March 1979 by Decreto Provincial E-No. 475 of the Governor of Catamarca Province. Subsequently enlarged in September 1983 under Decree No. 1954 of the Government of Catamarca. Approved as a Biosphere Reserve in 1982.

GEOGRAPHICAL LOCATION About 500km from the town of San Fernando del Valle de Catamarca in the north of Belén Department, Catamarca Province. 26°30'-27°00'S, 66°40'-67°30'W.

ALTITUDE 3,200-5,500m

AREA 981,620ha

LAND TENURE 200,000ha are privately owned by one proprietor who leases the land to 40 people. 3,000ha (Altura Experimental Station) belong to the province of Catamarca. Remaining area belongs to local communities.

PHYSICAL FEATURES A high plateau of the "Puna" region with a salty lagoon in the main depression. Surrounded by mountain chains lying in a north-north-east to south-south-west direction which are composed of schists showing varying degrees of metamorphism belonging to the Lower Palaeozoic era (Cambrian-Ordovician). There are few permanent rivers (mainly freshwater from the melting of ice and snow on the higher peaks) but several small lakes and many salt marshes. Soils are poor and sandy with little organic matter and are often saline. Climate is cold, arid and windy with great daily variation in temperature.

VEGETATION Typical upland open short saline shrub communities including species of the Compositae, Graminae, Leguminosae and Solanaceae families. Species of Adesmia, Fabiana, Parastrephia, Tetraglochyn, Neospartum and tough grasses such as Festuca, Stipa, Deyeuxia and Sporobolus occur. Hemicryptophytes are the characteristic dominant life form with a lesser proportion of nanophanerophytes and therophytes. All species are adapted to xeric conditions to some degree, except those which grow on inundated soils. Spiny forms are frequent and many plants are protected by a thick cuticle. A list of plant species in the Reserve is on file at the Division of Ecological Sciences.

FAUNA Mammals include vicuna Vicugna vicugna (V) in many herds totalling some 900 animals, colpeo fox Dusicyon culpaeus andinus, rodents including short-tailed chinchilla Chinchilla brevicaudata boliviana, mountain lion Felis concolor and Andean cat F. jacobita. Birds include lesser rhea Pterocnemia pennata garleppi, vultures including Andean condor Vultur gryphus and other birds of prey, flamingo Phoenicopterus spp. and ducks (Anatidae).

ZONING/CONSERVATION MANAGEMENT The core area of 163,450ha in the southwest of the reserve in the locality of Pasto Ventura was selected because of its inaccessibility and importance as vicuna habitat. The remainder of the reserve, 48,170ha, constitutes the buffer zone. Both the core area and the buffer zone are officially owned by the Government of Catamarca Province.

STAFF Total of 26 staff with 16 in administration and protection. Ten research staff.

LOCAL ADMINISTRATION Direccion de Ganaderia, Chacabuco 334, 4700 San Fernando del Valle de Catamarca, Republica Argentina.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Past research: plant and wildlife inventory, behaviour of vicuna, zonification and state of vegetation for management planning, meteorological observations and soil studies. Current studies: to establish optimal carrying capacities for livestock for the various plant communities of the reserve and work on the selection of llama for improving wool quality. Research facilities at Altura Experimental Station for which the local population donated the land and collaborate in research on rational livestock hubsandry. Also a meteorological station and a solar refuge for reserve rangers and scientific researchers is under construction.

LOCAL POPULATION Population of 345 in the buffer zone: 180 in the village of Laguna Blanca, 40 at Corral Blanco, 25 at Aguas Calientes and the remainder dispersed over the area.

MODIFICATION OF THE NATURAL ENVIRONMENT The core area is relatively undisturbed by man due to its inaccessibility. The main activity is livestock raising (sheep, goats, mules and cattle) with some vegetation cutting for fuel. About 50ha of tree plantations.

PRINCIPAL REFERENCE MATERIAL

Argerich, F.R. (1976). Fisiografia de la Provincia de Catamarca. Direc. Prov. de Cultural

Cabrera, A.L. (1957). La Vegetacion de la Puna Argentina. Revista de Investigaciones Agricolas 11(4).

Hofmann, R. and Otto, M. (2977). Utilizacion Racional de la Vicuna en el Peru. Asociac. Alemana Coop. Técnica.

Hofmann, R. (1971). Estado ACtual de la Vicuna y Recomendaciones para su Manejo. Conferencia Internac. sobre la Conserv. y Manejo Rac. de la Vicuna, Lima-Peru.

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Parque Costero del Sur

BIOGEOGRAPHICAL PROVINCE 8.31.11 (Monte, Argentinian Thorn-scrub)

LEGAL PROTECTION No information

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1984

GEOGRAPHICAL LOCATION Located on the coast between Bahia de Sanborombon and Rio de la Plata, 130km south of Buenos Aires and 80km from La Plata near the city of Partido (Magdalena).

ALTITUDE 0-8m

AREA 30,000ha

LAND TENURE No information

PHYSICAL FEATURES The reserve is an example of the variety of ecosystems assoicated with humid pampas. Three general types of terrain may be found. The first, that of low coastline, corresponds to the alluvial flat land of the Rio de la Plata which runs parallel to the coast. Despite the general flatness of the area. There is a micro-relief of 0-5m based on the superficial deposition of shell and coral matter. The orientation of the relief is parallel to the coast and limits the extent of flooding to which the area is prone both from rain and high tides. The soils in this area are alluvial, strongly hydromorphic and salty, resulting in water saturation for prolonged periods. The second type is a zone defined by undulating hillocks and sand dunes created by built-up bands of shell and coral that also run parallel and subparallel to the coast of Rio de la Plata and, further on, the littoral zone of the sea. The bands vary in width between 100 and 300m and encircle both wet and dry depressions depending on the height of the band's crest. The vertical thickness of the bands can reach 4 or 5 metres and they are covered by sand and loess in some sections which may alter the general topography and the undulations produced are more pronounced south of the Punta

Piedras. The soils of the areas are rendzinas on the high parts and generally go no deeper than 30-40cms down to the calcareas material. Hydromorphic and saline soils are found in the depressions. The bands are traversed by streams which run into the Rio de la Plata following well-defined courses and changing direction depending on the contours of the bands. The third type of terrain results from the network of tidal creeks which meander through the area at times dispersed and at times contained by small rises of clay and shell matter. The topography is undulating with generally hydromorphic, saline and alkaline soils.

VEGETATION The vegetation is successional with high tussocks of Salicornia sp., Spartina sp. and Zizaniopsis ibrasiliensis followed by a Celtis spinosa dominated zone.

FAUNA There are few mammal species. The skunk Conepatus sp. is found in the open areas as is the viscacha Lagidium viscaccia which is threatened by hunting. An introduced species, the European hare Lepus capensis is relatively abundant. Mountain cat Felis sp. and ocelot F. pardalis may still be found in one or two spots. Bird species are considerably more numerous and the reserve is an important place for migratory birds including Patagonian species in the austral winter and Nearctic species in the austral summer. Principal species include Luvialis squatarola, P. dominicana, Charadrius falklandicus, C. modestus and Limosa haemastica. Plegadis chihi, Chauna tarquata and Phoenicopterus chilensis are also found.

CULTURAL HERITAGE The reserve includes a variety of architectural monuments which illustrate the settlement and development of Argentina from 1750-1930. Most of this development was associated with the growth of the cattle industry which not only was integral to Argentine national identity but which also prompted the development of an associated folklore.

ZONING/CONSERVATION MANAGEMENT There is a protected reserve area for the fauna and flora; a recreation and tourism area, and a transit area.

STAFF No information

LOCAL ADMINISTRATION No information

VISITOR FACILITIES The reserve is being developed for its recreational potential.

LOCAL POPULATION Considerable as the reserve is closely connected with the city.

MODIFICATION OF THE NATURAL ENVIRONMENT The area is subject to considerable pressures from tourists and recreational interests which are likely to increase as the reserve is promoted for such purposes.

PRINCIPAL REFERENCE MATERIAL

CEPA (Centro de Estudios y Proyectacion del Ambiente) (1981). Propuesta de creacion de una reserva de biosfera natural y cultural.

Reserva Ecologica de Nacunan

BIOGEOGRAPHICAL PROVINCE 8.25.07 (Monte)

LEGAL PROTECTION Declared a forest reserve under Provincial Law No. 2821 of 21 July 1961; administered since 1970 by Research Institute for the Study of Arid Zones (IADIZA).

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1986, established as a forest reserve in 1961.

GEOGRAPHICAL LOCATION Situated in the province of Mendoza, roughly 200km south of the town of Mendoza and near the village of Nacunan. Rectangular shape of approximately 7km by 17km orientated longitudinally; 34°03'S, 67°58'W.

ALTITUDE Average 540m

AREA 11,900ha

LAND TENURE State-owned

PHYSICAL FEATURES Considered to be representative of the vast "Monte" biogeographical province and exemplifying arid and semi-arid desert conditions. Terrain consists of undulating hills intersected by ephermeral wadi streams, some of which lie in deep gorges. Eocene sedimentary deposits contribute to a system of mobile sand dunes which are as yet are unfixed by vegetation. The climate is dominated by the semitropical, semipermanent anticyclone air masses of the South Atlantic. Most of the rain, typically terrestrial, falls in the summer, during which time there is a great deal of run-off and the wadis become rushing streams. The prevailing winds are from the south-east with an average velocity of 9.8km/hour. The annual mean temperature is 15.4°C.

VEGETATION Two types of vegetation are represented - scrubby steppe, composed largely of isolated specimens for small stands of Prosopis flexuosa, Larrea divaricota and L. cuneifolia, and woodland. In the latter, three associations are identifiable: 1) arboreal with P. flexuosa, 2) shrubby in which L. divaricata predominates with Atriplex lanpa, Verbena aspera, Lycium chilensis, Atamisquea enarginata and Ephedra triandra and 3) herbaceous, formed essentially by graminaceous species such as Pappophorum caespitosum, Digitaria californica, Setaria leucopila, Sporobolus cryptandrius, Deplachne dubia and Munroa mendocina.

FAUNA Representative of the Central-Andean region and characterised by the convergence of distinct 300 geographical groups associated with the Patagonian Chacoan, Andean and pampas environments. Some of the species involved, such as the turtle Geochelane chilensis, the rhea Rhea anelicana and the partridge Nothoprocta cinerascens are threatened. Typical mammals include armadillos Chlamyphorus spp., grey fox Dusicyon griseus, Lyncodon patagonicus, Geoffrey's cat Felis geoffrayi and the jaguarandi Herpailurus yagouarundi. Birds such as eagles Buteo albicaudatus and Harpy aliaetus coronatus, the harrier Circus buffoni and the hawk Parabuteo unicinctus are also found here although all are considered to be threatened. Both the vicuna Vicugna vicugna and the boa constrictor Boa constrictor have been recently extirminated from the area.

CULTURAL HERITAGE Up until the end of the 19th century the area was inhabited by Indian tribes whose exploitation of the natural resources was defined by their hunter-gatherer subsistence patterns and who recognised their dependence

on the continued existence of such resources. Following the arrival of white settlers, rapid degradation of the environment occurred. The primitive forests of Prosopis flexuosa were almost totally eradicated to supply firewood to the city of Mendoza. This deforestation opened up the land successively to cattle and then goats which over-grazed the area and contributed to the process of decline which was further accelerated by the construction of a railway between Lencinas and Monte Caman, San Rafael.

ZONING/CONSERVATION MANAGEMENT Consists of a core area dedicated entirely to conservation and two buffer zones of which one of approximately 2,298ha is the most internal and directly protects the nucleus. The second buffer constitutes the remainder of the reserve. Scientific experiments may be carried out within a controlled area of 3,310ha in the second buffer zone. There is a further zone of 600ha on the outskirts which is exploited to some extent by local inhabitants.

STAFF One Director and a resident manager

LOCAL ADMINISTRATION IADIZA (Instituto Argentino de Zonas Arridas), Casilla de Carreo 705 - Carreo Central 5500 Mendoza.

VISITOR FACILITIES Recreational activities are not permitted in order to allow the reserve to recover and the number of visitors are restricted.

SCIENTIFIC RESEARCH AND FACILITIES Studies on general ecology, primary productivity, plant physiology, fauna and soils have been published and work continues. There is a biological station, which is at the disposal of visiting scientists and a meteorological station.

LOCAL POPULATION Parts of the reserve are exploited by the inhabitants of the village of Nacunan.

MODIFICATION OF THE NATURAL ENVIRONMENT At the time of the establishment of the reserve, the area was in an advanced state of degradation. In the outskirts of the reserve this degradation continues particularly as a result of large numbers of cattle and goats grazing. However, as a result of protection, the interior of the reserve has recovered. Indiscriminate hunting, particularly of skunks Conepatus sp. and wild cats (Felidae) has depleted the populations.

PRINCIPAL REFERENCE MATERIAL

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Cei, J.M. and Roig, V.G. (1973). Fauna y ecosistemas del oeste arido argentino. I. Reptiles de Provincia de Mendoza. DESERTA IV 69-71, IADIZA, Mendoza.

Contreras, J.R. (1979). Los vertebrados de la Reserva ecologica de Nacunan I. Lista faunistica preliminar Cuaderno Técnico II, IADIZA, Mendoza.

Roig, F.A. (1970). Flora y vegetacion de la reserva forestal de Nacunan. DESERTA II 25-232. IADIZA, Mendoza.

Tanquilevich, R. (1971). Los suelos de la Reserva Ecologica de Nacunan. DESERTA II 131-206 IADIZA, Mendoza.

Croajingolong

BIOGEOGRAPHICAL PROVINCE 6.06.06 (Eastern Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The park was delcared on 26 April 1979 under the (Victoria) National Parks Act (1975) and amalgamates Mallacoota, Captain James Cook and Wingan Inlet National Park. It was approved as a Biosphere Reserve in October 1977.

GEOGRAPHICAL LOCATION East Gippsland, Victoria. 37°27'-37°47'S, 148°59'-149°58'E.

ALTITUDE 0-492m

AREA 101,000ha including Nadgee Nature Reserve (15,00ha)

LAND TENURE State government

PHYSICAL FEATURES The park's main feature is 100km of unspoilt coastline. There are long stretches of sandy beach and spectacular dunes with local outcrops of rocky cliffs, often over 15m high. A variety of aquatic habitats includes tidal river inlets, freshwater lakes and swamps behind the coastal dunes. The largest of these lakes are Barracoota and Wau Wauka. The numerous rivers and small streams have led to a dissected topography of narrow valleys and low ridges. The underlying rocks are predominantly Ordovician sediments, Tertiary sandstones and siltstones which give extensive areas of deep, nutrient-poor sandy soils. There are also Devonian granites and granodiorites which form the peaks of the Howe Range, Mount Everard and Genoa Peak. Offshore are the skerries and Tullaberga Island. There is a warm, maritime climate with at least 60mm rainfall in all months.

VEGETATION There are a variety of habitats. Tall scrub occurs on the coastal dunes contrasting with the adjoining low sclerophyllous heaths with Casuarina spp., Xanthorrhoea spp. and Leptospermum spp. dominant. As soils improve, sclerophyllous woodland with a heath understorey has developed and merges into open forests of predominantly Eucalyptus spp.. In sheltered valleys there are small areas of species typical of the rainforests to the north, including Acmena smithii, Acacia melanoxylon and Tristania laurina. The heaths are particularly species-rich and, together with the rainforest outliers, are noted for the large number of species at the southern edge of their range, including Ficus coronata, Eucryphia moorei, Angophora floribunda and Notothixos subaureus.

FAUNA The diverse fauna includes viable populations of several rare species, particularly the smokey mouse Pseudomys fumeus, eastern ground parrot Pezoporus wallicus (V), eastern bristlebird Dasyornis brachypterus (R), southern emu wren Stipiturus malachurus and the beautiful firetail finch Emblema bella. The Australian fur seal Arctocephalus pusillus breeds on the Skerries. A number of birds are at the southern limit of their distribution. The coastline is important for breeding white-bellied sea eagle Haliaeetus leucogaster and there are breeding colonies of little penguin Eudyptula minor. Rare birds present include Indian blue quail Excalfactoria chinensis, Lewin honeyeater Meliphaga lewinii, glossy cockatoo Calyptorhynchus lathami and pearly-winged monarch Monarcha melanopsis. The diamond python Morelia spilotes represents the most southerly occurrence of the family Boidae.

CULTURAL HERITAGE Along the coast are numerous archaeological sites, evidence of the Aboriginal Kruatungulung clan who lived here before European settlement. Croajingolong is a corruption of their name.

ZONING/CONSERVATION MANAGEMENT A management plan is being prepared and an interim management plan has been prepared.

STAFF One ranger Grade IV, two rangers Grade III, two rangers Grade II, two rangers Grade I, four construction and maintenance workers and one Park Assistant. A Fisheries and Wildlife Officer is stationed in Mallacoota township. Other government departments, particularly the Forests Commission and Soil Conservation Authority, have field staff responsible for land within the park.

LOCAL ADMINISTRATION Ranger-in-Charge, Croajingolong National Park, PO Box 60, Cann River, Victoria 3889.

VISITOR FACILITIES Nearby Mallacoota is a popular resort in the summer months and accommodation is available in smaller centres along the coast. Access is by roads and tracks off the Princes Highway, some requiring four-wheel drive, and in wet weather access is unreliable.

SCIENTIFIC RESEARCH AND FACILITIES Studies have been made by the National Parks Service of flora, fauna, geology, geomorphology, archaeology, visitor use and history.

MODIFICATION OF THE NATURAL ENVIRONMENT The non-aquatic ecosystems are particularly modified by man by selective logging of sections of the Park and the introduction of foxes, feral cats and rabbits. None of the streams or rivers are dammed. Mallacoota is a resort township with heavy and increasing visitor pressure in the summer months and is the centre for a small local fishing industry including diving for abalone Haliotis spp.. Other centres along the coast also have some recreational use.

PRINCIPAL REFERENCE MATERIAL
Reports by the National Parks Service, published by the Ministry for Conservation, Victoria.

Danggali Conservation Park

BIOGEOGRAPHICAL PROVINCE 6.10.07 (Southern Mulga/Saltbush)

LEGAL PROTECTION Fauna and flora completely protected

DATE ESTABLISHED Established as a Conservation Park in 1976 under the S.A National Parks and Wildlife Act (1972-81) and as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION South Australia, 70 km north of the town of Renmark, adjoining the New South Wales border, 33°03-33°30'S, 140°31'-141°E.

ALTITUDE 150-300m

AREA 253,230ha

LAND TENURE State government

PHYSICAL FEATURES This is an area of undulating calcreted plains with shallow brown calcareous soils and outcrops of calcrete. Low mobile dunes and sheets of bright red sand are present.

VEGETATION The park straddles the vegetation gradient from semi-arid mallee/spinifex to arid Black Oak/Blue Bush vegetation types, with the two extremes and most intermediate stages represented. Mallee scrub has Eucalyptus oleosa as the dominant species in association with E. incrassata and E. socialis. Low open woodlands of black oak Casuarina cristata, false sandalwood Myoporum platycarpum and bullockbush Heterodendrum oleifolium have a semi-succulent understorey of shrubs. Low chenopodioid shrublands dominated by blue bush Maireana spp. and saltbush Atriplex spp. occur throughout the area. Rare plants include Calotis scapigera, Amyema gibberula, Grevillea huegelii, Geijera parviflora, Santalum spicatum and Duboisia hopwoodii (see Specht, R.L. 1972).

FAUNA Fauna of this area is not well known but includes red kangaroo Macropus rufus, western grey kangaroo M. fuliginosus, pebble mound mouse Pseudomys hermannsburgensis, greater long-eared bat Nyctophilus timoriensis and little pied bat Chalinolobus picatus.

ZONING/CONSERVATION MANAGEMENT None at present

STAFF Two resident Rangers are engaged full-time

LOCAL ADMINISTRATION Ranger-in-Charge, Danggali Conservation Park, South Australia. Administered by the NPWS Murraylands Regional Office, Berri, by Regional Superintendent.

VISITOR FACILITIES The park is accessible by two airstrips and has a network of vehicle tracks.

SCIENTIFIC RESEARCH AND FACILITIES The park has been the site of an intensive and continuing reptile survey by P.T. and T.P. Morley. It presents research potential to study regeneration of semi-arid and arid vegetation following the removal of sheep. Preliminary surveys have been undertaken of vegetation and mammals.

MODIFICATION OF THE NATURAL ENVIRONMENT Until 1976 the area was leased for sheep grazing. The vegetation was altered in both structure and floristic composition, particularly the chenopod pastures, but is in considerably better condition than neighbouring areas. Feral goats are a problem and contracts are let for their removal.

PRINCIPAL REFERENCE MATERIAL

Margules, C. (1978). The Status of Rare Plant Alliances, Birds and Mammals in S.A. (CSIRO).

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Kosciusko National Park

BIOGEOGRAPHICAL PROVINCE 6.06.06 (Eastern Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The park was established in 1944 under the Kosciusko State Parks Act and accepted as a Biosphere Reserve in January 1977. It is protected under the N.S.W. National Parks and Wildlife Act 1974.

GEOGRAPHICAL LOCATION The park situated in the rugged eastern Australian Highlands, 480km south-west of Sydney, 180km south of Canberra. 35°22'-36°55'S, 148°08'-45'E.

ALTITUDE 312-2,229m

AREA 625,525ha

LAND TENURE State government

PHYSICAL FEATURES This area of the Snowy Mountains has a long history of geological uplift and erosion, resulting in a rugged topography with many glacial features. Mount Kosciusko 2,229m is the highest peak in Australia. The oldest rocks are marine sediments up to 450 million years old, and there are many outcrops of granite, which is the most common rock in the area. There is an area of limestone karst at Yarrangobilly. Uplift has occured along a number of fault zones, some of which have been eroded by rivers like the Snowy, Thredbo and Swampy Plains rivers to form straight valleys. About 15% of the park is above 1,520m and has winter snow caps. Glacial activity has formed features such as Lake Albina, Blue Lakes and Hedley Tarn, moraines and corries. Parts of the alpine grasslands have soils with high organic contents and in some areas there are swamps and bogs. Temperatures are cool, and much of the rainfall is orographic, up to 2000mm on exposed slopes, but much less in rainshadow areas.

VEGETATION The great variation in relief and precipitation leads to a diversity of vegetation, most marked on the western escarpment. Lowland communities are dominated by snow gum *Eucalyptus pauciflora* and black sally *E. stellulata* in wetter areas and by red stringybark *E. macrorhyncha* and scribbly gum *E. rossi* on dryer stony areas. The mountain slopes are occupied by wet sclerophyll forests. Brown barrel *E. fastigata* and ribbon gum *E. viminalis* occur between 450 and 1,000m above sea level, grading into alpine ash *E. delegatensis* and mountain gum *E. dalrympleana* which grow up to an altitude of 1,500m. Above this, up to 1,830m, subalpine woodland, mainly snow gum, occurs. In the southern part, the dry, rugged snowy river catchment contains pure and mixed stands of native cypress pines *Callitris hugelii* and *C. endlicheri*. The alpine vegetation above 1,830m is characterised by low shrubs and herbs, forming heath, bog, grassland and fen communities.

FAUNA A diversity of species due to the varied habitats includes three endemic to the park, the mountain pigmy possum *Burramys parvus*, corroborce frog *Pseudophryne corroboree* and Mount Kosciusko wingless stonefly *Leptoperia cacuminis* (R) which is only known from one small stream in the headwaters of the Snow River. Other rare animals which also occur outside the park are the broad-toothed rat *Mastocomys fuscus* and Kosciusko grasshopper *Kosciuskola* sp..

CULTURAL HERITAGE Aboriginal people only visited the area in the summer and there is no evidence to suggest their more permanent occupation. In the 1830s

Europeans brought sheep and cattle to graze here in summer and there was a short-lived goldrush.

ZONING/CONSERVATION MANAGEMENT A complex system has been devised to safeguard the natural resources while developing tourism as much as possible. The first management plan was adopted in 1974 but a new one replaced it a few years later, which included detailed proposals for protecting the outstanding natural resources, managing Aboriginal sites, wilderness management and wildlife conservation. A major part deals with the provision of access and visitor facilities, particularly in connection with ski resorts.

STAFF No information

LOCAL ADMINISTRATION No information

VISITOR FACILITIES Winter sports are well developed and hotels, ski lifts and car parks are operated by concessions. In summer the area is popular for trout fishing and trail riding. There are also campsites and hiking trails.

SCIENTIFIC RESEARCH AND FACILITIES Surveys have been made of many aspects of the flora, fauna and landscape, including a study of the alpine flora (Costin et al., 1979). There are no special facilities for research.

LOCAL POPULATION Some people are involved with running the tourist developments.

MODIFICATION OF THE NATURAL ENVIRONMENT Grazing had considerable impact in the past. The Snowy Mountains Hydro-Electric Scheme developed in the 1940s-1970s had a large impact on the park's appearance and ecology. Eastern flowing rivers were diverted westwards for irrigation and power and access roads and power lines were constructed into remote areas. The development of ski centres has put strong pressures on the fragile wilderness areas.

PRINCIPAL REFERENCE MATERIAL

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Macquarie Island Nature Reserve

BIOGEOGRAPHICAL PROVINCE 7.04.09 (Insulantarctica)

LEGAL PROTECTION Total

DATE ESTABLISHED The island was declared a Nature Sanctuary in 1933. Under the Tasmanian National Parks and Wildlfife Act 1970 it was declared a Nature Reserve on 14 June 1972. Approved as a Biosphere Reserve in 1977.

GEOGRAPHICAL LOCATION In the Southern Ocean, about half way between New Zealand and the Antarctic continent, approximately 1500km south-east of Tasmania. The island is part of the State of Tasmania, administratively within the local government area of Esperance. 54°30'-54°47'S, 158°48'-158°57'E.

ALTITUDE 0-433m

AREA Nature Reserve 12,785ha; Biosphere Reserve 12,343ha.

LAND TENURE State government

PHYSICAL FEATURES The island is 34km long and up to 5km wide. It consists of a horst block of igneous Miocene or Pliocene rocks, which have been subject to marine and glacial erosion. The main feature is a central rolling plateau 250-300m above sea level, bounded on all sides by steep cliffs, from the foot of which extends a coastal platform 10-800 wide. The coastline is generally rocky with a number of stacks and islands offshore. Glacial drift up to 20m thick covers much of the plateau and there are numerous deep lakes and ponds of glacial origin. Soils are gravelly loams and peat. The island has a cold temperate oceanic climate with small annual or diurnal variation in temperature; mean annual temperature is 4.4°C, and annual rainfall 900mm and there are frequently strong westerly winds and heavy cloud. The Antarctic Convergence lies 200-250km to the south.

VEGETATION Macquarie Island has no trees but an extensive low vegetation which includes 38 native species. Poa tussock grassland covers the well-drained coastal terraces, slopes up to 300m and protected upland flats. Herbfields dominated by Pleurophyllum hookeri and Stilbocarpa polaris with Ranunculus biternatus and Agrostis magellanica occur on flats and slopes where winds are moderate and the water table is high. Fens of rush and sedge occupy wet flats, with, where the water table is at the surface, (Carex trifida, Juncus scheucheroides and Scirpus aucklandicus). Low-growing feldmark, especially Azorella selago cushion, covers most of the exposed uplands above 180m but may occur as low as 90m. Acid peat bog is restricted to the northern parts of the raised coastal terrace. Giant kelp grows luxuriantly in the surrounding waters and the beaches are heavily littered with its remains. Three species of introduced weeds are well established but of these, only the grass Poa annua are widespread. There are three endemic vascular plants, P. hamiltoni, Deschampsia penicillata and Puccinellia macquariensis. The island is rich in lower plants including 50 moss, 30 liverwort and 55 lichen species, about a third of the lichens being endemic.

FAUNA There are no native land mammals but many marine mammals breed or visit the shores. It is a major breeding site for southern elephant-seal Mirounga leonina. Two others, the New Zealand fur seal Arctocephalus fosteri and Amsterdam Island fur seal A. tropicalis, have recently recolonised and begun regular breeding. Several hundred sub-adult leopard seal Hydrurga leptonyx visit in winter. The island is also important for seabirds and 20 species breed here, including four penguins, the king penguin Aptenodytes patagonica (over 15,000) rockhopper penguin Eudyptes crestatus (over 200,000), gentoo penguin Pygoscelis papua (10,000-20,000) and royal penguin E. schlegeli (over two million, which are not known to breed elsewhere). Four species of albatross and seven of petrel also breed on the island (see Rounsevell and Brothers, 1984). A few passerine species have spread naturally from New Zealand, including red poll Acanthis flammea and starling Sturnus vulgaris.

CULTURAL HERITAGE Sealers discovered the island in 1810 and inhabited it periodically throughout the nineteenth century, exterminating the fur seals and greatly reducing the elephant seal population. In 1870, gangs came to exploit the king and royal penguins also for oil, eliminating the former. These visitors brought exotic mammals including cats, rats Rattus ratus, wekas Galliallus australis scotti, mice Mus musculus and rabbits Oryctolagus cuniculus, and caused the extermination of two endemic subspecies of land birds, the banded rail Rallus phillippensis macquariensis and red-fronted parakeet Cyanoramphus novaezelandiae erythrolis.

ZONING/CONSERVATION MANAGEMENT Two zones for management purposes, the isthmus, where development is concentrated, and the remainder of the reserve. The management plan draft was completed in 1984 and strict enclosure zones may be established. Access is generally limited to official researchers. Some tourist cruise vessels were allowed to land until 1982 but quarantine regulations have stopped this. Firearms, the collection of specimens and introduction of plants or animals are controlled by permits. Since 1970, much rabbit control has been undertaken by introducing the rabbit flea Spilopsyllus cuniculi as a vector fo myxomatosis. Cats and wekas are also shot or trapped, and both these species had been reduced to very low numbers by 1984.

STAFF The Australian National Antarctic Research Expedition (ANARE) station has been permanently manned since 1949 by approximately 20 (in 1981) personnel from the Commonwealth Antarctic Division. The NPWS (Tasmania) maintains one technical officer throughout the year, sometimes two in summer. The officer-in-charge of the ANARE base is generally appointed an honorary ranger under the National Parks and Wildlife Act.

LOCAL ADMINISTRATION National Parks and Wildlife Service, PO Box 210, Sandy Bay, Hobart, Tasmania 7005.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES An active programme is conducted under the auspices of ANARE, by an overwintering staff with visiting university and government scientists. A meteorological station was established in 1948 and is still maintained. Research is wide-ranging to include upper atmospheric physics and seismology. Recently it has focussed on seabird and mammal ecology, causes of erosion and the effects of introduced animals and their control. There is a base and six field huts, but transport and accommodation impose limitations and difficulties.

LOCAL POPULATION There are no permanent residents although the ANARE base is maned all year round.

MODIFICATION OF THE NATURAL ENVIRONMENT Many of the natural populations of seal and seabirds have now recovered fully with the control of pest species although the grey petrel Procellaria cinerea has probably not returned to breed (Jones, 1980) and the white-headed petrel Pterodroma lessonii is probably declining in numbers (Warham, 1967). Rabbits have been the main threat in the past, causing widespread vegetation changes and providing an abundance of prey for cats and the main native predator, the brown skua Catharacta lonnbergi which is now declining as a result of rabbit control (Jones and Skira, 1979). Alien vertebrates are the main threat now to native species and the relationships between the two faunas are complex and difficult to assess.

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Prince Regent River Nature Reserve

BIOGEOGRAPHICAL PROVINCE 6.03.04 (Northern Coastal)

LEGAL PROTECTION Total

DATE ESTABLISHED Declared a Nature Reserve in 1964, the area was accepted as a Biosphere Reserve in October 1977. Under the 1933 Land Act, the Governor may reserve land for public purposes, and the Western Australian Wildlife Authority was established under the Wildlife Conservation Act 1950-1980 to manage reserves. The National Parks Authority Act 1976 provides for the establishment of parks and reserves and established the National Parks Authority of Western Australia to manage them. The reserve is a class 'C' under the Lands Act and may be altered by Ministerial Notice or Gazette but is a 'prohibited area' under the Wildlife Conservation Act, for which a permit is required for entry.

GEOGRAPHICAL LOCATION Located in the extreme north of Western Australia, in the sub-humid zone of North West Kimberley; 15°00'-16°00'S, 124°45'-125°45'E.

ALTITUDE 0-850m

AREA 633,825ha

LAND TENURE State Government

PHYSICAL FEATURES The area has a varied relief. In the southern part the rugged, deeply dissected sandstones of the Prince Regent Plateau slope from about 500m in the south-east to less than 100m around the St. Georges Basin. The Prince Regent Lineament cuts north-west south-east across the area.

St. Georges Basin is a deep landlocked harbour bounded by precipitous cliffs with large expanses of tidal mud-flats and mangroves, connected to the sea by a narrow strait. In contrast, the area to the north of the Roe River is underlain by volcanic rocks, mainly basalts, interbedded with sandstone and has a subdued topography with rounded hills and deeper soils. In the north-east the hills are capped by remnants of an old Tertiary Lateritic surface, a southern extension of the Mitchell Plateau.

VEGETATION The reserve includes a wide range of plant communities from mangrove at sea level to open woodland and grassland in the upland areas. During a biological survey of the reserve in August 1974, 64 plants collected constituted new records for Western Australia, bringing the total of known taxa to 502. Of these, 19 were fungi, 43 lichens, 19 ferns, two gymnosperms and 419 flowering plants. The most common woodland trees are Eucalyptus miniata, E. tetradonta, E. polycarpa and E. latifolia with some Melaleuca leucadendra and M. viridiflora. Mangrove species include Aegiceras corniculatum, camptosteman schultzii, Phizophora stylosa and Sonnerata alba.

FAUNA The Kimberley region has at least 65 species of native mammal but the reserve has not been extensively surveyed and only 38 mammal species have been recorded from it. Many plants and animals of this sub-humid zone are also found in the wet north-west area of Northern Territory although the drier country of the Joseph Bonaparte Gulf separates them; two such birds are the Australian Pied Imperial Pigeon Ducula spilorrhoa and Emerald Dove Chalcophaps indica. The bat fauna includes the central flying fox Pteropus alecto, Schreiber's long-fingered bat Miniopteris schreibersii and Gould's wattled bat Chalinolobus gouldii.

CULTURAL HERITAGE Until recently, three Aboriginal tribes inhabited the area and have left many rock paintings of Wandjina spirit figures, humans, snakes, possums and flying foxes.

ZONING/CONSERVATION MANAGEMENT The reserve is infrequently visited, due to its 'prohibited area' status, remoteness and ruggedness. Therefore, little management is required.

STAFF None

LOCAL ADMINISTRATION Western Australian Wildlife Authority, 108 Adelaide Terrace, Perth, W.A. 6000.

VISITOR FACILITIES The area is remote and infrequently visited. A permit is required which has to be approved by the relevant Aboriginal Council because of the cultural significance of the area to them.

SCIENTIFIC RESEARCH AND FACILITIES The reserve provides a completely protected catchment undisturbed by industrialised man, and this feature, together with its diverse fauna and flora, provides considerable opportunity for scientific research.

MODIFICATION OF THE NATURAL ENVIRONMENT Apart from the presence of feral cats and feral cattle and occasional visits by Europeans, the area remains unmodified.

PRINCIPAL REFERENCE MATERIAL

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Southwest National Park

BIOGEOGRAPHICAL PROVINCE 6.02.02 (Tasmanian)

LEGAL PROTECTION Total

DATE ESTABLISHED Most of the area was declared a State Reserve on 16 October 1968 under the Animals and Birds Protection Act 1928 and the park is now protected under the Tasmanian National Parks and Wildlife Act 1970. Additions were made on 17 November 1976 (17,149ha); 1 December 1976 (3,800ha) and 13 May 1981 (49,300ha). The park was approved as a Biosphere Reserve in October 1977. It was one of three parks in western Tasmania placed on the World Heritage List in December 1982 as the Western Tasmanian Wilderness Parks.

GEOGRAPHICAL LOCATION In the Southwest Conservation Area, 154m from Hobart; 42°45'-43°33'S, 145°38'-146°45'E.

ALTITUDE 0-1,250m

AREA 403,240ha

LAND TENURE State government

PHYSICAL FEATURES The park includes 120km of coastline on the south-west corner of Tasmania, several offshore islands (excluding Maatsuyker) and a large enclosed marine waterway, Port Davey-Bathurst Harbour. There are numerous peaks of folded Pre-Cambrian quartzite including the Arthur Range, which runs approximately north-south through the centre of the park. Rivers have eroded the softer schists to form steep-sided valleys and Pleistocene glaciation has left erosional features such as cirques and tarns. Also included is the shallow, man-made Lake Pedder, covering 25,000ha. The area has a temperate climate a high rainfall of up to 3600mm.

VEGETATION The park contains 180 of the 310 plant species endemic to Tasmania and four main communities. Temperate rainforest occurs up to 1,000m but mainly in valleys and on fire-protected slopes. It is dominated by myrtle beech Nothofagus cunninghamii. Also present is the long-lived huron pine Dacrydium fraklinii. There is also wet sclerophyll forest dominated by swamp gum Eucalyptus regnans. Extensive areas of the lowland plains are sedgelands dominated by button grass Gymnoschoenus sphaerocephalus which partly owes its extent to continuing fires. Above 1,000m are sub-alpine and alpine moorlands of bolster moorlands, herbfield, bog communities and shrublands containing the endemic pine Diselma archeri. The flora has some affinities with that of New Zealand and Chile.

FAUNA The fauna of the park is not well known compared to that in other parts of Tasmania. The 22 species of mammals include Tasmanian devil Sarcophilus

harrisii, tiger cat Dasyurus maculatus, native cat Dasyurus viverrinus, wombat Vombatus ursinus, brush tailed possum Trichosurus vulpecula, red-necked wallaby Macropus rufogriseus, rufous pademelon Thylogale billardieri and a number of smaller rodents and marsupials including the broad-toothed rat Mastacomys fuscus and the endemic long-tailed rat Pseudomys higginsi. This area may be the last habitat for the Tasmanian tiger Thylacinus cynocephalus. Another species endemic to Tasmania which is found in the park is the Tasmanian tree frog Litoria burrowsii. The avifauna includes 12 species endemic to Tasmania and two endangered species, the ground parrot Pezoporus wallicus of which the Tasmanian subspecies leachi is fairly common, and the orange-bellied parrot Neophema chrysogaster (R) breed in the park, both are restricted to the wet sedgeland and coastal grassland. The Tasmanian mountain shrimp Anaspides tasmaniae is common in highland lakes and tarns. About 25% of the 4,500 invertebrate fauna recently surveyed in one area were new species.

CULTURAL HERITAGE The earliest Tasmanians arrived over 20,000 years ago, before Tasmania was cut off from Australia by rising sea level after the last Ice Age. Many Aboriginal sites have been discovered but little detailed investigation carried out. They include engravings, an ochre quarry and stone arrangements. The last Aboriginal people were removed in 1833.

ZONING/CONSERVATION MANAGEMENT There are no formal zones in the park, but development is currently restricted to the area of the hydroelectric impoundment. It is proposed that most of the park be zoned "wilderness area" with some very limited "development areas" around areas of existing developments and "special areas" at sites of historical and anthropological significance. An initial draft of a Management Plan was prepared in 1972 and revised 1976. In 1984 it was awaiting finalisation. Since the cessation of the Gordon-below Franklin HEP scheme, investigations into alternative areas for tourism have been carried out by the Department of Tourism. The Southwest Adivsory Committee was set up in 1975 and detailed studies made of the area's resources and their possible management. However, insufficient funds have prevented the planning and management required, to cope with increased pressures, being carried out. The Tasmanian Fisheries Development Authority cooperatives with the NPWS in marine areas.

STAFF One Ranger and one Assistant Ranger, based in Strathgordon

LOCAL ADMINISTRATION Senior Ranger, Mount Field National Park, Tasmania 7465.

VISITOR FACILITIES Most tourism occurs in the area around Lake Pedder. The demand for wilderness exploration is increasing, including river rafting and canoeing. Strathgordon, on the northern shore of Lake Pedder and just outside the park, received 50,000 visitors in 1981/82.

SCIENTIFIC RESEARCH AND FACILITIES Research has been limited. No special facilities are available and travelling is difficult within the park, particularly between May and November.

LOCAL POPULATION There are no permanent residents within the park, although two families live in the excluded area at Melaeuca.

MODIFICATION OF THE NATURAL ENVIRONMENT The park includes the artifical Lake Pedder which flooded the natural lake and its remarkable quartzite beach. Felling of huron pine around Port Davey in the past has led to disturbance here. An area of 65ha around Cox Bight and Melaleuca Inlet was omitted from the park for tin mining. Wildfires threaten the remnant temperate rainforest. Tourist impact is low, but bush walkers have degraded some areas,

particularly fragile alpine areas and light aircraft fly low in places. More research is needed to enable efficient management.

PRINCIPAL REFERENCE MATERIAL

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The Unnamed Conservation Park of South Australia

BIOGEOGRAPHICAL PROVINCE 6.09.07 (Central Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established as a Nature Reserve in 1970 and approved as a Biosphere Reserve in January 1977. It is protected under the South Australia National Parks and Wildlife Act, 1972-1974.

GEOGRAPHICAL LOCATION The reserve is an inverted L-shaped area adjoining the South Australian/West Australian border, 80km north of the Transcontinental Railway and adjoining the North West Aboriginal Reserve. 28°5'-30°11'S, 129°-131°E.

ALTITUDE 150-495m

AREA 2,132,600ha

LAND TENURE State government

PHYSICAL FEATURES The reserve includes part of the Great Victoria Desert which is an old erosional surface of Archaean rocks. Low dunes extend over the area, often 20m in height and up to 100km long with an easterly trend. Sand sheets, occasional clay pans and gypsum or saline areas in lake beds also occur. On the dunes the soils are red siliceous sands while between the dunes red earthy sands have developed.

VEGETATION On the dune slopes there is porcupine grass Triodia spp. with marble gum Eucalpytus gongylocarpa and E. oleosa in the north or E. pyriformis and E. transcontinentalis in the south. In the swales, mulga Acacia aneura with, in the south, black oak Casuarina cristata dominate over Atriplex and

Kochia spp. Acacia shrubs dominate mobile dune crests and semi-succulent species are common on gypsum and saline areas in lake beds. Threatened species are Frankenia cordata, Thryptomene elliottii and Goodenia rotundiflora. The area is significant for the conservation of a large number of species, particularly eucalypts, endemic to the area. Because of the remote nature of this reserve, little is known about the biota.

FAUNA A number of interesting mammal and bird species occur in the park but further investigative work is required. The stick-nest rat Leporillus apicalis and night parrot Geopsittacus occidentalis may still occur in the area. The species are representative of the Australian arid zone.

CULTURAL HERITAGE This is one of the most sparsely populated areas of Australia. Little is known about its Aboriginal history.

ZONING/CONSERVATION MANAGEMENT There is no management plan yet and the area is little disturbed or visited. Inspections are made periodically by the District Ranger from Streaky Bay.

STAFF None resident; occasional inspection by District Ranger from Streaky Bay

LOCAL ADMINISTRATION Ranger-in-Charge, Streaky Bay, South Australia.

VISITOR FACILITIES The two road tracks are only suitable for four-wheel drive vehicles and water is scarce. Entry is by permit only.

SCIENTIFIC RESEARCH AND FACILITIES The Ecological Survey Unit of the Department of Environment and Planning conducted a botanical survey in 1979 and several expeditions from the Nature Conservation Society of S.A. have investigated the biology of the area. One scientific permit has been issued for ornithological research and there is an environmental monitoring programme.

LOCAL POPULATION None

MODIFICATION OF THE NATURAL ENVIRONMENT The area is virtually undisturbed and this is probably one of the least altered parks in Australia. Lack of water has prevented heavy grazing by sheep. There is no resident ranger and a need still for basic research and surveys of the flora and fauna. There are no research facilities.

PRINCIPAL REFERENCE MATERIAL

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Uluru (Ayers Rock-Mount Olga) National Park

BIOGEOGRAPHICAL PROVINCE 6.09.07 (Central Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED The area was formerly part of the Petermann Aboriginal Reserve and was reserved on 23 January 1958 under Section 103 of the Northern Territory Crown Lands Ordinance 1931-1957 for the purpose of a national park, under the name Ayers Rock-Mount Olga National Park. On 24 May 1977 it was declared a national park under the Northern Territory National Parks and Wildlife Act 1975 and its name modified to the present form. In January 1977 it was approved as a Biosphere Reserve.

GEOGRAPHICAL LOCATION The park is in the south-west part of Northern Territory, 335km south-west of Alice Springs, at approximately 24°25'-24°26'S, 130°40'-131°20'E.

ALTITUDE 600-1,069m

AREA 132,550ha

LAND TENURE State government

PHYSICAL FEATURES The magnitude of Ayers Rock and Olga monoliths and the physical contrast they afford with the surrounding plain are the main reason for their national and international importance. Ayers rock is a huge flat-topped block of coarse sandstone, the Mount Currie Conglomerate, with a base about three by two kilometres, rising nearly vertically to 340m above the surrounding desert. Around the base of the rock there are cave-like hollows eroded by sand-blast. The Olgas are 32km to the west and comprise a group of steep-sided round topped seven by five kilometres. These also rise abruptly from their surroundings and between them are steep-sided valleys. Mount Olga, the highest point in the park (1069m above sea level) stands 546m above the plain. Most of the park is a plain of Quaternary sand and alluvium with areas of sand dunes up to 30m high. The soils have low fertility and some are susceptible to erosion, particularly the coarser grained areas around the bases of the monoliths. Annual rainfall is about 310mm and surface water scare although pools form around the bases of the monoliths after heavy rain and may persist for months. High winds and temperatures result in high evaporation rates from other pools. One waterhole, Maggie Springs, remains through all but the driest of years. Aquifers at present supply potable water, though this has high nitrate and flouride levels. Temperatures range from -4°C at night in July to 44°C on January days.

VEGETATION The vegetation can be grouped into three major components: upland communities on the monoliths and foothills with hard spinifex Triodia irritans the dominant plant; communities on areas affected by runoff supporting mainly mulga; and sand plain and dune field communities where soft spinifex T. pungens predominates. Over 390 species from 64 families are included in the park checklist (Dunstan, 1977). Plants are generally of low stature with scattered trees and shrubs and all are adapted to drought. Rare plant species include Stylidium inaequipetalum and Parietaria debilis at Ayers Rock, Eriachne scleranthoides in parts of the Olgas and Ophioglossum lusitanicum subsp. coriaceum, Isoetes muelleri and Triglochin calcatrapa in the Valley of the Winds.

FAUNA This is reasonably well known, and 22 mature mammals and over 150 bird species have been recorded (Roff, 1978a and 1978b). There are three large mammals, the red kangaroo Macropus rufus, wallaroo M. robustus (in the immediate vicinity of the Olgas) and dingo Canis familiaris. Many small mammals are nocturnal, with deep burrows. Rare or endangered mammals include marsupial mole Notoryctes typhlops, stripe-faced dunnart Sminthopsis macrura, ghost bat Macroderma gigas (V), brown desert mouse Pseudomys deertor, rabbit-eared bandicoot Macrotis lagotis (E) and mulgara Dasycercus cristicauda. There are 66 resident birds including several parrots: mulga parrot Psephotus varius and Port Lincoln ringneck Barnardius zonarius. The reptile fauna is varied and fairly well known (Cawood, 1978) but the amphibians and insects have been little studied.

CULTURAL HERITAGE Aboriginal tribes have lived in this area for thousands of years, particularly around the monoliths. There are many aboriginal rock paintings in the caves around the base of Ayers Rock and there is a network of tracks, based on the routes of mythical ancestors, criss-crossing the park. Small-scale fires have been caused by Aboriginies for centuries, and may have led to the large number of fire-resistant plant species in the area.

ZONING/CONSERVATION MANAGEMENT Formal zoning has not yet been instituted. The management plan under preparation provides for seven zonal classes: protection of rare flora; wilderness areas; mulga environment; intensive use areas; major road corridors; minor road corridors; and interpretative tracks. A management plan was published in 1982 by the Australian National Parks and Wildlife Service to run until July 1987. Development on soil liable to erosion would be limited and access to waterholes and caves restricted to prevent further damage. Certain plant communities were to be protected, particularly on Ayers Rock and Olga foothills and fire management improved. Introduced plants were to be removed where practicable, and new introductions guarded against. A fauna monitoring program was planned which would include the study of the effects of fire. Management would take into account the importance of tree hollows for nesting birds, Spinitex for some reptiles and surface water for breeding frogs. There was to be an attempt to eradicate feral cats and reduce the rabbit population; the entry of dogs is limited. Aboriginal sites were also to be protected and Aboriginals to be consulted on this. Management for visitors would continue to provide some day-use amenities at Ayers Rock and the Olgas.

STAFF A senior ranger with four rangers, two mechanics, one clerical assistant and five labourers.

LOCAL ADMINISTRATION Ranger-in-Charge, Private Mail Bag 17, Ayers Rock, via Alice Springs, NT 5750.

VISITOR FACILITIES This area and the Great Barrier Reef are Australia's two most popular sites for overseas visitors. There were about 77,000 visitors in 1979/1980. A number of enclaves within the park have been leased for motels, campsites, a store and service station. However, these and the former airstrip located only one kilometre from Ayers Rock, are spoiling the natural beauty of the area. Therefore on 29 July 1976 an alternative location, the Tulara Townsites comprising 104 sq.km was proclaimed. This was intended to provide facilities for 3,560 overnight visitors by 1984, and a new airstrip nearby is now in use. There is a new information centre, many walks are signposted and a safety chain was installed to assist visitors to climb to the top of Ayres Rock. There is access via air and unsurfaced roads, although some roads around Ayers Rock are sealed.

SCIENTIFIC RESEARCH AND FACILITIES A great deal of research has already been carried out, some being outlined above. Priorities for research include fire management and rabbit control, further floral and hydrological surveys and the identification of sites important to Aboriginals.

LOCAL POPULATION About 80 Aboriginals have traditional residential and ritual rights and live in several family groups, and may help the preservation of their culture. A number of people connected with tourist facilities live in enclaves and Yulara Village.

MODIFICATION OF THE NATURAL ENVIRONMENT The location of tourist facilities too near Ayers rock is being resolved by development further away at Yulara Village. Information about biological, cultural, social and economic aspects of the park is limited and hinders the adoption of appropriate management policies. Rehabilitation of areas damaged by past use is necessary and visitor services still need further development in view of the site's national and international popularity.

PRINCIPAL REFERENCE MATERIAL

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Yathong Nature Reserve

BIOGEOGRAPHICAL PROVINCE 6.13.11 (Eastern Grassland Savannas)

LEGAL PROTECTION Total

DATE ESTABLISHED The area was protected as a Nature Reserve under the (N.S.W.) National Parks and Wildlife Act (1974) and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION West of Narrandera, New South Wales, centred 32°40'S, 145°30'E.

ALTITUDE 300m

AREA 107,241ha

LAND TENURE State government

PHYSICAL FEATURES A series of north-south ridges of Upper Devonian sandstone extend through the reserve, interspersed with flats. The ridges have thin, poorly developed soils which have suffered considerable erosion in places by rain and westerly winds. The plains are flat to gently undulating, made up of Quarternary red and brown clays and sand. Dune deposits of these clays and irregular deposits of sand occur in the western part of the reserve. The climate is subtropical with low rainfall, mostly in summer.

VEGETATION There are two main associations: mallee and cypress pine. The mallee stands in the south of the reserve are thought to be relics of a more arid climate. Dominant species include Eucalyptus dumosa, E. oleosa and E. socialis which reach 2-6m, depending on soil depth and type. White cypress pine Callitris callumellaris occur in association with brimble box E. populnea or red box E. intertexta and can reach over 12m in height.

FAUNA There are populations of eastern grey kangaroo Macropus giganteus, red kangaroo M. rufus, short-nosed echindna Tachyglossus aculeatus and brush-tailed possum Trichosurus vulpeca. Many seed-eating birds occur, including crested bellbird Oreoica gutturalis, Major Mitchell's cockatoo Cacatua leadbeateri and red-loved whistler Pachycephala rufogularis. The rare striated grass wren Amytornis striatus is found here, and also the threatened mallee fowl Leipoa ocellata.

CULTURAL HERITAGE Little is known about the Aboriginal history of this area although some Aboriginal relics have been found in the sandstone hills. Galleries containing stencilled handpoints have been recorded in small caves, but Aboriginal paintings are unknown.

ZONING/CONSERVATION MANAGEMENT There is as yet no management plan but management is strictly in accordance with general policies.

STAFF Total of eight staff with resident manager, district ranger and ranger staff based at district headquarters at Griffith.

LOCAL ADMINISTRATION Officer-in-Charge, Griffith District, N.S.W. National Parks and Wildlife Service, PO Box 1532, N.S.W. 2680.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has been carried out on red kangaroos, mallee fowl and introduced rabbits.

MODIFICATION OF THE NATURAL ENVIRONMENT Feral animals are a problem, particularly rabbits, goats, pigs and foxes. The area was formerly a sheep grazing area, but many of the ridges were too steep and good representatives of the main habitats remain.

PRINCIPAL REFERENCE MATERIAL No information

Fitzgerald River National Park

BIOGEOGRAPHICAL PROVINCE 6.04.06 (Western Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The park was declared on 19 January 1973 and accepted in April 1978 as a Biosphere Reserve. Under the 1933 Land Act, the Governor may reserve land for public purposes and the Wildlife Conservation Act, 1950-1980, established the Western Australian Wildlife Authority to manage reserves. The National Parks Authority Act, 1976, established the National Parks Authority of Western Australia to manage national parks and reserves and provides for the establishment of parks. The park is a class 'A' reserve, requiring parliamentary approval for change of purpose.

GEOGRAPHICAL LOCATION On the south coast of Western Australia with the western half in Gnowangerup shire and the eastern in Ravensthorpe shire. The Gairdner river terminating in the Gordon inlet, forms part of the western boundary, and the Phillip River terminating in the Culham inlet, forms part of the eastern boundary. 33°43'-34°24'S, 119°05'-120°05'E.

ALTITUDE 0-457m

AREA 242,727ha

LAND TENURE State government

PHYSICAL FEATURES Most of the park consists of an undulating sand plain frequently underlain by laterite and dissected by many small water courses which are tributaries of four south-east flowing rivers, the Fitzgerald, Gairdner, Phillips and Hamersley. These have incised valleys, the Hamersley and Fitzgerald having colourful cliffs of spongolite, a marine deposit. The rivers terminate in broad inlets which are often cut off from the sea by sandbars which can become stabilized by vegetation, such as Culham Inlet. A series of spectacular isolated metamorphic peaks and mountain ranges formed of Pre-Cambrian quarzites of the Mount Barren Beds, traverse the park from west to east. East of the Fitzgerald river they slope directly into the sea with the shoreline consisting of steep scree slopes or sea cliffs. West of Fitzgerald Inlet are uninterrupted beaches backed by dunes including areas of more stable dunes further inland. Temperatures are mild and rainfall varies from 630mm on the coast to 400mm per annum inland.

VEGETATION The vegetation is diverse with over 600 recorded species of which 60 are endemic to the park. Beard (1976) recognised two main vegetation systems, both part of the Eyre botanical district the Quaolup system and Barren Range system. The Quaolup system is more extensive and mainly represented by mallee heath on sand plains sediments in which an open mallee eucalypt layer emerges above a closed heathland rich in Myrtaceae. Tallerack Eucalyptus tetragona is dominant, but at least other eucalypt species occur and taller Banksia spp. may replace eucalypts on deep sands. River valleys are usually dominated by closed eucalypt mallee while woodlands of swamp yate Eucalyptus occidentalis or paperbark Melaleuca parviflora occur immediately adjacent to larger water courses and on the numerous small pans that flood in winter. The Barren Range system contains similiar elements to the Quaolup system with mallee heath and closed heath on a mountain pediment and in river valleys respectively. Coastal areas are colonised by scrub upto about 1.5m high characteristic of much of the south-west coast with the notable absence of peppermint Agonis flexuosa east of the Gordon Inlet. The most important

community is the Barren Ranges Thicket containing a core of typical species including oak-leaved Dryandra Dryandra quercifolia and Bell-fruited mallee Eucalyptus preissiana. Most of the rare plants are found on the mountains, some only known from one or two peaks. Some plants here have affinities with South American and South African floras.

FAUNA The fauna is not well known with eleven native mammals recorded. Western Grey Kangaroo Macropus fuliginosus, brown bandicoot Isoodon obesulus and brush-tailed possum Trichosurus vulpeca are most common and Tammar Macropus engenii occur, probably at the eastern extreme of their range. Over 100 bird species have been recorded, including western whipbird Psophodes nigrogularis, crested bellbird Oreoica gutturalis and mallee fowl Leipoa ocellata.

CULTURAL HERITAGE The area is relatively undisturbed and probably not much settled in the past. There are remains of a copper mine, a homestead and a telegraph line, but limited water supplies probably discouraged settlement.

ZONING/CONSERVATION MANAGEMENT No zoning at present except a 200m peripheral buffer system associated with fire protection. A management plan was drawn up in 1977 by F.G. Smith.

STAFF One ranger lives in Jerramungup and two Assistant Rangers are based at Quaolup and at East Mt. Barren.

LOCAL ADMINISTRATION Director of National Parks, Hackett Drive, Nedlands, Western Australia, 6009.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Several uncoordinated flora and fauna collections have been made in the Park and a vegetation map at 1:250,000 has been compiled but not published. These studies have involved personnel of the W.A. Museum, W.A. Herbarium and Department of Fisheries and Wildlife. The geology of the area is fairly well-known because of the mineral deposits. Current research is a major flora survey by a post-graduate student of the West Australian Institute of Technology and the University of Western Australia periodically examinines specific ecological phenomena. A search for the dibbler Antechinus apicalis was proposed for late 1977 by Dr P. Woolley of La Trobe University, Melbourne. Comprehensive baseline data are required on all environmental aspects except the flora and the geology. Research which would significantly aid management includes: the effects of fire on the environment; the possible existence and potential for spread of dieback disease caused by the fungus Phytophthora cinnamomi; and the potential impact of tourism and tourist facilities such as roads. The area offers great potential for a comprehensive study of the ecology of an undisturbed and diverse ecosystem in the southern hemisphere experiencing cool wet winters and warm dry summers, and for the study of speciation and biogeographical relationships of south-west Australian flora and fauna with south-east Australia and the rest of Gondwanaland. The park is well serviced with tracks suitable for four-wheel drive vehicles and is within one day's drive on sealed roads from Perth.

LOCAL POPULATION There are a few small towns around the park.

MODIFICATION OF THE NATURAL ENVIRONMENT There have been no major alterations of the natural ecosystems by man with the possible exception of the effects of unnatural fire and the extermination of some mammal species following the

introduction of feral animals such as rabbits, foxes, cats and house mice. A system of tracks and roads provide access to and within the area. Visitor pressure is increasing in the coastal areas but impact is low except at a few localised camps where encroachment into vegetation for shelter is occurring.

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Hattah-Kulkyne National Park and Murray-Kulkyne Park

BIOGEOGRAPHICAL PROVINCE 6.05.06/6.13.11 (Southern Sclerophyll and Eastern Grasslands and Savanna)

LEGAL PROTECTION Total

DATE ESTABLISHED The park was declared in 1980 under the (Victoria) National Parks Act 1975 and accepted as a Biosphere Reserve in October 1981. Part of the area, the Hattah-Kulkyne Lakes, were designated as a Ramsar site in April 1983.

GEOGRAPHICAL LOCATION The two parks are contiguous, located in north-western Victoria between the Murray River and Calder Highway about 50km south of Mildura; 34°20'-34°50'S, 142°20'-142°45'E. Hattah-Kulkyne Lakes are about 34°40'S, 142°29'E.

ALTITUDE 40-70m

AREA 49,500ha including Hattah-Kulkyne Lakes (1,018ha)

LAND TENURE State Government

PHYSICAL FEATURES The parks cover an extensive area of the Murray River floodplain and are composed of Quaternary alluvium and relict Pleistocene sand ridges. A network of about 20 freshwater lakes linked to the Murray by Chalka Creek fill intermittently when the Murray floods. Clay soils with a high salt content occur at three separate localities and varying degrees of salination occur in parts of the lake system and sandhills. In the south is the Lendrock Plain, a flat basin with shallow soil overlying 'copi', a form of gypsum. Mean annual temperature are 23.5°C maximum and 9.6°C minimum. Mean annual rainfall is 275-300mm.

VEGETATION Many plants are ephemeral due to the low rainfall. Four main vegetation types occur. Mallee covers the largest area, with white mallee Eucalyptus gracilis dominant on sandy loams in the north-west and yellow mallee E. incrassata on deep sands of the Zig Zag Ridge. Open riverine

woodland covers large areas and is dominated by river red gum E. camaldulensis and black box E. largiflorens. Grasses and herbs flourish after periodic river floods. On the open sandhills, bull-oak Casuarina luehmannii and native pine Callitris spp. dominate but this woodland has been largely destroyed by felling, fires and grazing. The woolly scurf pea Psoralea eriantha and rare desert chinese lantern Abutilou otocarpum are found almost exclusively here. The saline flats have a particular flora including glassworts Arthrocnemum spp.. Rare plants present include Spyridium tridentatum and Sida ammophila.

FAUNA Ten native mammals, 29 reptiles, six amphibian species, 14 species of fish and over 200 bird species have been recorded. The lakes are of international importance as breeding places for thousands of waterbirds including herons, egrets and spoonbills, after periods of flooding. The park is the only one in Victoria where red kangaroo Macropus rufus can be seen and this is the very edge of their range. Western grey kangaroo M. fuliginosus are, however, abundant. Mallee fowl Leipoa ocellata are present but rare and there are good populations of two rare birds, the striped grass wren Amytornis striatus and Rufons-crowned emu wren Stipiturus ruficeps.

ZONING/CONSERVATION MANAGEMENT Several zones have been demarcated: a natural zone, covering most of the park, and historic, reference, education, development and special use zones cover smaller areas. A management plan has been formulated. All livestock are excluded from the area.

STAFF Nine

LOCAL ADMINISTRATION Ranger-in-Charge, Hattah-Kulkyne National Park, R.S.D. Hattah, via Mildura, Victoria 3501.

VISITOR FACILITIES There are sites for camping and caravans and horse-riding, hiking, fishing, swimming and boating is possible. Access is easy, as the area is adjacent to two major highways and a major railway line.

SCIENTIFIC RESEARCH AND FACILITIES The effects of regeneration following the removal of livestock has been studied and also the effects of vermin and fire on the flora and fauna. Current research is investigating the effects of feral cats on native animals and impact of rabbits and kangaroos on vegetation regeneration. Research facilities are negligible but informal accommodation is sometimes available.

MODIFICATION OF THE NATURAL ENVIRONMENT Riverine communities have been disturbed and modified by heavy grazing in the past. Although livestock are now excluded, rabbits still exert a critical seasonal pressure. Feral cats and foxes are also a problem. Timber cutting in the past has depleted the area, leading to a reduction in Callitris spp. and Casuarina spp. in particular, as rabbits hinder their regeneration.

PRINCIPAL REFERENCE MATERIAL

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Wilson's Promontory National Park

BIOGEOGRAPHICAL PROVINCE 6.06.06 (Eastern Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED This is Victoria's oldest park, established 8 July 1898, with further additions between 1908 and 1969. It is now protected under the (Victoria) National Parks Act 1975 and was accepted as a Biosphere Reserve in October 1981.

GEOGRAPHICAL LOCATION 250km south-east of Melbourne in south Gippsland, southern Victoria. The park is the southernmost part of the Australian mainland, centres 39°00'S, 146°25'E.

ALTITUDE 0-770m

AREA 49,000ha

LAND TENURE State government

PHYSICAL FEATURES The park is noted for its spectacular coastal scenery. It consists of a rugged peninsula of Devonian granite linked by an isthmus of sand to the main continental land mass. Mount Latrobe 770m is the highest point on the promontory. At least ten varieties of granite have been identified. Overlying the granite in some areas are Quaternary swamp deposits, colluvium, sand ridges, dunes and sandy beaches. Aeolianite outcrops on the west coast. The promontory forms the boundary between the two main sand types in southern Australia: the yellow lime-rich sands to the west and the white siliceous sands to the east. The park includes 15 granite islands. At an altitude of 89m mean daily minimum and maximum temperatures are 11.1°C and 16.2°C and annual precipitation is 1050mm.

VEGETATION Vegetation on the granite areas consists predominantly of mixtures of wet and dry Eucalyptus forests, modified in places by fire to a variety of scrublands and rocky heathlands. In the more sheltered gullies, cool temperate rainforest with Nothofagus cunninghamii, Atherosperma moschatum and the southernmost remnants of warm temperate rainforest with Acmena smithii occur. Coastal heath and scrub cover some of the dunes and the swamp areas contain dense Melaleuca thickets. Extensive heathlands occur in the north. Over 740 indigenous vascular plants have been recorded including at least 15 rare to Victoria and 19 at the limit of their geographic ranges. Rare or endangered species include Acacia verticillata var. latifolia, Asplenium obtusatum, Australina pusilla, Burnettia cuneata, Caladenia leptochila, Cyathodes juniperina, Lepidium praetervisum, L. halmaturinum, Lindsaea trichomanoides, Lycopodium myrtifolium, Olearia allenderae and Pimelea drupacea. Australian, Indo-Malaysian and Antarctic elements are represented in the flora. There are some areas of mangroves, including the southernmost stand in the world, of Aricennia marina.

FAUNA The variety of unmodified habitats leads to a diverse fauna, including over 26 mammal, 237 bird, 14 reptile and nine amphibian species. Some rare mammals which are well represented in the park include swamp antenichus Antenichus minimus, New Holland mouse Pseudomys novaehollandiae, long-nosed potoroo Potorus tridactylus and white-footed dunnart Sminthopsis leucopus. Australian fur seal Arctocephalus pusillus live on the islands. The promontory is an important flyway for birds moving between Tasmania and Australia and the avifauna includes at least 29 oceanic birds and many waders. There are large breeding colonies of short-tailed shearwater Puffinus tenuirostris and little penguin Endyptula minor. Landbirds of note include ground parrot Pezoporus wallicus (V) and Cape Barron goose Cereopsis novaehollandiae.

CULTURAL HERITAGE During periods of glaciation, when sea level fell, a land bridge with Tasmania extended from the promontory and facilitated Aboriginal migration. This bridge was broken 12,000 years ago. Aboriginies gathered shellfish in the area and heaps of shells in middens can still be seen. In the early 1880s, sealers and whalers operated here. A small sawmill operated and tin mining occured in the latter half of the mid nineteenth century.

ZONING/CONSERVATION MANAGEMENT Zoning has yet to be finalised. Most of the park will be zoned as a natural area (conservation and recreation) and wilderness. Other zones will be: reference or natural area (special protection); natural area (special management and fire protection); natural area (limited resource use with grazing); historic (conservation and education); historic (special protection); development (Tidal River); and special use (including limestone quarries and transmitter station). Management plans have been drawn up for the park and the Tidal River visitors' area. The area is well managed and tourist development controlled. Exotic plants and animals are controlled as much as possible and there is an active education programme to promote better understanding of the natural environment.

STAFF Sixty-five staff including construction and maintenance workers

LOCAL ADMINISTRATION District Superintendant, South Gippsland District, National Parks Service, Yanakie via Foster, Victoria 3960.

VISITOR FACILITIES There is a visitor's centre at Tidal River with lodges, a store and cafe. These and campsites are in great demand during holiday seasons. There are facilities for swimming, hiking, non-power boating and fishing. The park is only three hours from Melbourne by sealed road.

SCIENTIFIC RESEARCH AND FACILITIES Research has included flora and fauna surveys, detailed investigations into specific vegetation types and animals, studies of vegetation history, vegetation mapping, effects of fire on vegetation and fauna, archaeological investigations, research into the geology of the park, particularly the granites, the geomorphology of coastal landforms and recreational surveys. Monitoring is carried out of sand movements on coastal dunes, post-fire succession in scrub communities and heathlands and soil movement along walking tracks. Research potential is high due to the length of time that the area has been reserved as a park, the relatively natural state of the ecosystems and the island nature of the park. A laboratory and accommodation are available at Tidal River.

LOCAL POPULATION Sixty people live permanently at Tidal River, and 22 in the northern part of the park.

MODIFICATION OF THE NATURAL ENVIRONMENT Past activities in limited areas have included seal-hunting, whaling, timber milling, mining, quarrying and army training. Seasonal grazing continues on some 7,000ha in the northernmost part of the isthmus and agricultural limestone is extracted on three small leases. Fire protection works have modified parts of the promontory particularly in the north. Ecosystems are generally natural, although partly affected by man-caused fires. Visitor pressure has had some effect on local areas particularly around Tidal River which has a permanent population of about 60 and a peak visitor capacity of 6,000, including day visitors. Man-made features include a lighthouse, navigations lights and a telecommunication station. Seals are sometimes killed by fishermen.

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Gossenköllesee

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1952, all lakes of the Tirol and 500m around their shores were protected. This area was accepted in January 1977 as Biosphere Reserve.

GEOGRAPHICAL LOCATION About 40km west-south-west of Innsbruck, in the northern range of Stubaier Alps, near the village of Kühtai. 47°14'N, 1°01'E.

ALTITUDE Lake water level at 2,413m; catchment area extends to 2,828m.

AREA Total area 100ha; the lake is 1.64ha

LAND TENURE Local government

PHYSICAL FEATURES Gossenköllesee is a typical oligotrophic high-mountain lake, of small area and moderate depth (maximum depth 9.9m, mean depth 4.8m). The lake is dimietic with maximum surface temperatures of 13°C. Winter ice cover lasts about 8 months, achieving a maximum thickness of more than 2m. The lake water is very transparent, with very low electrolyte concentrations (conductivity around 20 micro-mhos) and high oxygen content in all depths throughout the year. There is no superficial in or outflow. The lake bottom consists predominantly of gravel and boulders. The small alpine catchment area is predominantly siliceous rocks. There is a small cirque lake (Rotfelssee, 2,485m) in the catchment of Gossenköllesee.

VEGETATION The lake contains only nanoplanctic, epilithic and epipelic algae; macrophytes are completely lacking. The catchment area is typical high-altitude lichen heath and alpine meadows.

FAUNA The lake is the habitat of a large number of brown trout Salmo trutta which were introduced by man in the 15th or 16th century. Because of their complete isolation since that time the Gossenkollsee population is of special interest. In Rotfelssee, Arctic char Salvelonus alpinus from Fuschlsee were introduced in 1969. The salmonids in both lakes are allopatric.

CULTURAL HERITAGE The main impact of man in the past is the introduction of fish from the 15th century on.

ZONING/CONSERVATION MANAGEMENT Little management is carried out

STAFF One scientist and one technician full-time; further research is done by unpaid doctoral candidates and part time assistants.

LOCAL ADMINISTRATION For limnology and terrestrial aspects: Limnology Division, Institute of Zoology, University of Innsbruck, Universitätsstr. 4, A-6020 Innsbruck, Austria.

VISITOR FACILITIES None

SCIENTIFIC RESEARCH AND FACILITIES The new building of the Limnological high-mountain Station of the Institute of Zoology, University of Innsbruck, was built on the shore of Gossenköllesee in 1975. This new station has the necessary equipment to register various environmental factors in a computer-compatible form. The relatively simple structure of high-mountain lakes in general, and the modest size of Gossenköllesee in particular, provide

a sound basis for an ecosystem study and for quantitative autecological investigations on its biota. Additionally, there are possibilities for terrestrial studies in the catchment area.

LOCAL POPULATION The mountainous surroundings are sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT No information

PRINCIPAL REFERENCE MATERIAL

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Gurgler Kamm

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1952, all lakes of the Tirol and 500m around their shores were protected. This area was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the south-eastern part of the Otztaler Alps between the Königstal and Rotmoostal valleys. Community area of Sölden, near the village of Obergurgl. 46°51'N, 11°04'E.

ALTITUDE 1,900-3,400m

AREA 1,500ha

LAND TENURE Local government

PHYSICAL FEATURES The geology consists of alternate layers of acid silicious slate and calcium carbonate. The west-north-west exposed slopes have boulder and rock fields, with glaciers on the upper parts. The main river valleys in the area are: the Rotmoostal, Gaisbergtal, Ferwalltal and Königstal.

VEGETATION Swiss stone pine Pinus cembra, larch Larix decidua and green alder Alnus viridis occur up to timberline at about 2000m. Dwarf shrub of Rhododendron ferrugineum, bilberry Vaccinium myrtillus, bog whortleberry V. uliginosum and trailing azalea Loiseleuria procumbens communities from the timberline to about 2,300m give way to alpine grassland of different composition depending upon the local geology. Representative species include Carex curvula and Elyna myosuroides. Extended lichen-heath, cushion-plant communities and open vegetation of the nival zone occur at the highest elevations of plant colonisation.

FAUNA Snow mice Microtus nivalis, snow hare Lepus timidus and chamois Rupicapra rupicapra are found in the area. In association with changing soil pH there are various communities of micro-organisms and soil fauna.

CULTURAL HERITAGE The alpine grassland has developed its character partly from five centuries of summer grazing by sheep and cattle.

ZONING/CONSERVATION MANAGEMENT There is a 30ha core area with a 1,300ha buffer zone. Obergurgler Zirbenwald is now a protected area. Total protection of Rhododendron terrugineum is expected in the very near future.

STAFF About 20 to 30 scientists per year make temporary visits to the area.

LOCAL ADMINISTRATION Alpine Forschungsstelle Obergurgl (AFO), University of Innsbruck, A-6020 Innsbruck, Austria.

VISITOR FACILITIES This area is popular with tourists, particularly for ski-ing, but there are no facilities reported in the reserve.

SCIENTIFIC RESEARCH AND FACILITIES Since 1951 the area has been the site of intensive geological and biological investigations by the University of Innsbruck's Alpine Research Station at Obergurgl. Intensive study-sites (Hohe Mut, Wiese and Rosskar) of the MAB-6 Programme Obergurgler are located in the reserve.

LOCAL POPULATION This alpine area is fairly sparsely populated in terms of resident population, with villages in the valley bottoms.

MODIFICATION OF THE NATURAL ENVIRONMENT The alpine grassland has been used more than five centuries as pasture for sheep and cattle. A few parts have been strongly influenced by overgrazing. Within the last 20 years tourism, particularly skiing, has become a dominant environmental concern.

PRINCIPAL REFERENCE MATERIAL See publication list of the Alpine Research Station Obergurgl (AFO), University of Innsbruck.

Lobau Reserve

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was originally established in 1905 and made a Landscape Protection Zone in 1954. It was accepted in October 1977 as a Biosphere Reserve. It was declared a Ramsar Site in December 1982.

GEOGRAPHICAL LOCATION On the left bank of the Danube in the south-eastern portion of the federal district of Vienna, just east of the city. 48°10'N, 16°32'E.

ALTITUDE 150-155m

AREA 1,000ha

LAND TENURE Federal district of Vienna

PHYSICAL FEATURES This is an area of floodplain adjoining the Danube. It includes ox-bow lakes, pools, gravel ridges and river terraces. The Danube floods some of the area annually.

VEGETATION The reserve is part of the largest area of watermeadows of their type in Europe. There are a variety of habitats, including 651ha of forest, 182ha of meadows, 94ha of water, reedswamps and thorn scrub. The swampy riverside woodland includes black poplar Populus nigra, white poplar P. alba

and willow Salix purpurea while in dryer areas there are English oak Quercus robur, lock elm Ulmus minor, pear Pyrus piraster and field maple Acer campestre. Rare plants include Turk's cap lily Lilium martagon, L. bulbiferum and Helleborus dumetorum.

FAUNA Birds are abundant and 104 species have been recorded, many of which breed. They include penduline tit Remiz pendulinus and black woodpecker Dryocopus martius; white-tailed sea eagle Haliaeetus albicilla used to breed here but now only over-winters. Mammals include red deer Cervus elaphus and Eurasian beaver Castor fiber recently reintroduced. The warm, dry gravel banks are favourite haunts for reptiles and insects and invertebrates include Apatura hypsipyle, Zerynthia populi, Cossus cossus and Saperda populnea.

CULTURAL HERITAGE Lobau was once a protected hunting area for the Austrian Imperial Family.

ZONING/CONSERVATION MANAGEMENT Two core areas are surrounded by a buffer zone. In the buffer zone there are marked paths and limited logging and agriculture are allowed. Visitors are only allowed accers at certain times. The core zones are strictly protected, with no disturbance.

STAFF This has included workers from the Lobau Scientific Council and the Limnological Department of the Austrian Academy of Sciences.

LOCAL ADMINISTRATION Townhall of Vienna, MA Inneres and Bürgerservice, Stadtrat P. Schieder, Rathaus Stiege 4, 1082 Vienna, Austria.

VISITOR FACILITIES The reserve may be visited between 1300 and sunset on Sundays and bank holidays. There are many marked footpaths and a museum. Accommodation is available nearby in Vienna.

SCIENTIFIC RESEARCH AND FACILITIES Scientific activities are mainly concerned with botanical and limnological problems. Vegetational mapping has the area's main vegetation zones. Current studies include investigations of aquatic and halophytic vegetation and of the limnology of certain backwaters and ox-bow lakes. It is also planned to establish a research centre close to the buffer zone in the near future.

LOCAL POPULATION The reserve is adjacent to the city of Vienna.

MODIFICATION OF THE NATURAL ENVIRONMENT In the buffer zone limited logging, agriculture and tourist access is allowed. Water levels have been altered since the Danube was regulated in the late nineteenth century. There is pollution, particularly from neighbouring Vienna. Tourism is exerting some pressure, although at present excluded from the core zones. Although the HEP scheme at Hainburg, which would have seriously affected the area, has been abandoned, a suggested alternative dam within Vienna may also affect this site.

PRINCIPAL REFERENCE MATERIAL

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Wirth, H. (Ed.)(1979). Nature Reserves in Europe. Edition Leipzig, Leipzig.

Neusiedler See-Osterreichischer Teil

BIOGEOGRAPHICAL PROVINCE 2.12.05 (Pannonian)

LEGAL PROTECTION Total

DATE ESTABLISHED Parts of the area were designated a Landscape Protection Zone in 1962 with additional area in 1965. The Austrian part of the Nesiedler See was accpeted as a Biosphere Reserve in January 1977 and designated a Ramsar site in December 1982.

GEOGRAPHICAL LOCATION On the Pannonian Plain, 45km south-east of Vienna, on the Wulka River in the Federal Province of Burgenland. 47°40'-56'N, 16°40'-160°52'E.

ALTITUDE 114m average

AREA 25,000ha

LAND TENURE Mostly private ownership; 440ha leased by WWF Austria (expired 1985)

PHYSICAL FEATURES Neusiedler See is the largest salt lake in Europe, being 30kmn long and 7.5km wide at its broadest point but only 1m deep on average. Its basin is tectonically formed of Tertiary and recent sediments. The high salt content is mainly due to carbonates and sulphates originating from underground water which reaches the surface through fissures in the rock. Water levels fluctuate due to high evaporation rates in summer, although this is now regulated by sluices; in 1865 the lake dried out completely, and smaller lakes on its shore dry out frequently, leaving a brilliant white salt coating on the lake floor. The lake is mesotrophic and has low transparency. The climate is moderately continental, with a mean annual temperature of 10°C, Mean monthly summer maximum of 30°C and mean monthly winter minimum of -10°C. Water temperatures vary from 0°C to 25°C.

VEGETATION Reedbeds of Phragmites australis cover about half the lake area. Within the open reed-free zone there is a clearly defined region with spiked water milfoil Myriophyllum spicatum and fennel pondweed Potomageton pectinatus. On the shores are many halophytic plants, including glasswort Salicornia prostrata saltmarsh grass Puccinellia spp., sea aster Aster tripolium and pepperwort Lepidium crassifolium. In the meadows to the north are a number of rare plants, including yellow pheasant's eye pasque flower Pulsatilla grandis, violet pasque flower P. nigricans and wormwood Artemisia lacinata.

FAUNA The lake is of primary importance for birds. Over 300 species hae been recorded, 130 of which breed on the shores, including all the reed-dwelling birds of central Europe. Of these, reed warbler Acrocephalus scirpaceus is commonest, but rare species such as moustached warbler A. malanopogon, bearded tit Panurus biarunicus, penduline tit Remiz pendulinus and bluethroat Luscinia svecica also occur. The reedbeds are also a major breeding site for waterbirds, including purple heron Ardea purpurea, great white egret Egretta alba and spoonbill Platalea leucorodia. There are large numbers of migrants passing through in autumn and spring including 60,000 greylag geese Anser anser, upto 30,000 white fronted geese A. albifrons and 10,000 bean geese A. fabiis. There are a number of reptiles and amphibians including Orsini's viper Vipera ursinii. In the damp northern meadows is a steppe species of moth Chondrosoma fiduciaria. Among the commoner fish are white bream Blicca bjoerkna, ruffe Gymnocephalus cernuus and pike perch Stizostedion lucioperca.

ZONING/CONSERVATION MANAGEMENT Parts of the area are designated nature reserves, within the area of the protected landscape: the heronries are strict sanctuaries, for example. Management guidelines have been drawn up. The water level of Neusiedler See has been controlled since 1956 by sluices on the Einser Canal. Some of the grassland around the lake was probably forested once but developed through grazing, which is continued, to maintain the meadows; WWF Austria has provided subsidies for maintaining cattle here. No industrial and no new residential development is allowed in the area. Some reed cutting and wildfowling is permitted to continue.

STAFF Biological Station, Federal County of Burgenland - five research workers; MAB-5 project - seven people; WWF - two workers for general protection of WWF reserves.

LOCAL ADMINISTRATION Biologische Station Illmitz, Abteilung f. Okosystemforschung, Donnerskirchen, Burgenland, Austria.

VISITOR FACILITIES There are facilities for fishing, swimming and boating, observation platforms, marked footpaths and a lake museum. About 67,000 tourists visit the lake each year and there is accommodation in villages nearby. Information leaflets are available. The nature reserve areas may not be entered.

SCIENTIFIC RESEARCH AND FACILITIES Hydrological and meteorological programmes exist on a year-round basis. Biological studies include research on migratory species, the ecology of various warblers and the herring gull. MAB Project No. 5 research was directed toward quantification of human impacts on the lake's flora and fauna. Research programmes include the MPI-Vogelwarte Radolfzell and eutrophication research under the OECD project.

LOCAL POPULATION There are a number of villages and small towns around the lake, and much of the surrounding area is agricultural, with many vineyards.

MODIFICATION OF THE NATURAL ENVIRONMENT Developments around the lake, associated with tourism, have increased rapidly in the last decade but the greater part of the reedbed is undisturbed. Some reed cutting occurs, and shooting is allowed in some areas. The Wulka River which flows into the lake contains high artificial nutrient levels, particularly in Autumn, during the sugar beet season. The lake's level is artificially controlled. There are introduced species such as muskrat Ondatra zibethica and eel Anguilla anguilla.

PRINCIPAL REFERENCE MATERIAL

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Reserva de la biosphere de la Pendjari

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Total. Sport fishing is allowed with authorization (though commercial fishing is prohibited).

DATE ESTABLISHED Established as a National Park in 1961 by Decree No. 132/FR/MAC/CF. First protected as a classified forest and partial faunal reserve (in effect a sport hunting zone) in 1954 by Decree No. 8839 ST/F and subsequently as a total reserve (classified forest and total faunal reserve) in 1955 by Decree No 2579. This brought total legal protection to flora and fauna, and annulled all rights of use and access by the local population. Accepted as a Biosphere Reserve in 1986.

GEOGRAPHICAL LOCATION In Atakora province, north-west Benin, on the international border with Burkina Faso. Within the loop formed by the River Pendjari, 45km north of Natitingon. 11°N, 1°30'E.

ALTITUDE 150-450m

AREA The biosphere reserve covers an area of 880,000ha. 275,500ha if the Parc national de Boucle de la Pendjari; contiguous to Pendjari (200,000ha) and Atakora (175,000ha) Hunting Zones, as well as Arly Total Faunal Reserve (76,000ha) in Burkina Faso. There are several hunting zones to the east. The core are for the Biosphere Reserve is 295,000ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve, which lies within the Volta depression, contains a wide variety of the habitats typical of the West Africa savanna region. The Pendjari River and its floodplain border the park to the east and north, and the River Yapiti to the west. To the south, the quartzite cliffs of the Atacora massif are a distinctive feature, though these are not actually within the park itself. North of these quartzite cliffs, the rock formations are principally schists and sandstones of the Buem series, which form a band 30km wide running parallel to the cliffs. In the centre of this band, a series of long, narrow hills run north-east south-west. Beyond the Buem series to the north, the Voltaïen series comprises further sandstones and schists. Soils are in general ferruginous, and a high proportion are seasonally waterlogged. Annual rainfall 1,000 falling from May to September. Early in the dry season daily temperatures range 38°-44°C (10°-16°C at night) with hot dry winds from the north-east, but by March-April daily temperatures reach 38°-44°C (26°-30°C at night). Temperatures fall to 19°-31°C during the wet season.

VEGETATION The reserve is situated in a zone of interchange between Soudanienne and Soudano-guinéenne savanna. Twenty-three vegetation types have been described from this area by Green (1977; 1979), though these can be grouped into six major zones: gallery forest; riverine forest; the floodplain of the Pendjari, with several savanna and woodland savanna zones (the distribution of which depend largely on the depth and duration of flooding); the hills of the Buem series with mainly wooded and shrubby savanna; open forest and wooded savanna with Anogeissus leiocarpus (mainly on the better drained soils, and (often coincident with old settlements); and woodland and shrubby savanna of the interior. This last zone covers the major reserve of the park, and is composed of a mosaic of formations resulting from topographic variations. The shrubby savanna is dominated by Detarium microcarpum,

Combretum spp., Acacia spp. and Crossopteryx febrifuga, while the woodland savanna (mainly found on the deeper soils) is composed principally of Butyrospermum paradoxum, Burkea africana, Afzelia africana and Pterocarpus erinaceus.

FAUNA Many of the West African savanna species occur in this area, including: lion Panthera leo, leopard P. pardus (T), wild dog Lycaon pictus (T) (only two pairs have been seen since 1970, prior to 1970 it was fairly common), cheetah Acinonyx jubatus (T), elephant Loxodonta africana (T), hippopotamus Hippopotamus amphibius, bushbuck Tragelaphus scriptus, roan antelope Hippotragus equinus, waterbuck Kobus ellipsiprymnus, kob K. kob, Bohar reedbuck Redunca redunca, western hartebeest Alcelaphus buselaphus, red-fronted gazelle Gazella rufifrons, red-flanked duiker Cephalophus rufilatus, common duiker Sylvicapra grimmia, oribi Ourebia ourebi, buffalo Syncerus caffer, topi Damaliscus lunatus (limited distribution in West Africa), warthog Phacochoerus aethiopicus, Anubis baboon Papio anubis, vervet monkey Cercopithecus aethiops, and patas monkey Erythrocebus patas. It has been suggested that giraffe Giraffa camelopardalis, giant eland Taurotragus derbianus and the black rhino Diceros bicornis (V) (present here at the turn of the century) could be reintroduced to the park. Some 250 bird species have been recorded from the park, with raptors particularly diverse comprising 37 out of the 89 known African species. Nile crocodile Crocodylus niloticus (V) has been reported and C. cataphractus (I) is probably also present. Python sebae and the monitor Varanus niloticus are recorded. Kinixys belliana, an uncommon tortoise species inhabits the marshes and water courses. There are a large number of fish species including dog fish Hydrocynus sp., and captains Lates niloticus, both of commercial value to local fishermen. Sayer et al. (1979) give a list of species.

ZONING/CONSERVATION MANAGEMENT The total area of the biosphere reserve is 880,000ha, of which the Pendjari National park (275,000ha) and its proposed extension (20,000ha) form the central core. A further 388,000ha constitute the game reserve zone where all activities are prohibited except for "game tourism" (visiting hunters with permit) and scientific research: this zone is made up by the Atakora Game Reserve and its proposed extension and part of the existing Pendjari Game Reserve. Another 20,000ha of the Pendjari Game Reserve constitutes the "Controlled Game Use Zone" used for game ranching and hunting. There is a further 177,000ha of "buffer zone" where agriculture, stock-raising and fruit gathering are to be allowed on a sustainable basis. A management plan for this area was prepared by FAO consultants in 1979 (which also included a proposal for extensions to the park).

STAFF The park is the largest employer of unskilled workers in the province; the local people supply some 22,000 man days of labour per year maintaining the roads, etc.

LOCAL ADMINISTRATION Inspection de la protection de la nature et de la chasse, Natitin Gou.

VISITOR FACILITIES There is a small hotel and some 300km of tourist roads. 2,113 visitors were reported in 1975-1976. Camping is permitted with the permission of the park administration.

SCIENTIFIC RESEARCH AND FACILITIES A lot of scientific work has been carried out in the park in connection with the FAO/UNDP project which has resulted in preparation of the management plan. In particular Green (1977; 1979) reports on the vegetation of the area, and Leovinsohn and Green (1981) on the mammals.

MODIFICATION OF THE NATURAL ENVIRONMENT Brushwood fires, lit for hunting purposes over-thousands of years, or, over the last 30 years, for the purpose of viewing animals, have caused the appearance of a pyroclimatic savanna, of a pseudonatural appearance. The natural balance is disturbed by poaching on an indeterminant scale. Occasional chemical pollution of some areas of water affects the fish in the reserve. A minor area of the reserve (30,000ha) on the western and southern borders of the Zone Cyregetique de la Pendjari has been cleared for the development of agriculture and large scale habitation (17 village). Livestock breeding is little developed in the region, but the encroachment of the desert is forcing the herds of cattle from Burkina Faso and Benin.

PRINCIPAL REFERENCE MATERIAL

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Sayer, J.A. (1981). Tourism or Conservation in the National Parks of Benin. Parks 5(4): 13-15.

Parque Nacional Pilon-Lajas

BIOGEOGRAPHICAL PROVINCE 8.06.01 (Madeiran)

LEGAL PROTECTION Declared a national park under the general law on wildlife 12,301 of 14 March 1975.

DATE ESTABLISHED 14 March 1975 as National Park; approved as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION On the far eastern spur of the cordillera of the Andes; the nearest human settlement is San Borja, 70km from the western boundary of the park. 15°00'S, 67°20'W

ALTITUDE 280-2,000m

AREA 100,000ha

LAND TENURE State property

PHYSICAL FEATURES Sub-tropical and tropical forest associated with Amazonian deposits. A variety of plant associations and ecological environments characteristic of the different altitudes and degrees of humidity, etc. Landscapes of exceptional scenic beauty deserve priority as a protected area.

VEGETATION The flora of the reserve corresponds to the sub-hylean tropical vegetation with forest canopies containing emergents in some zones. Pioneer vegetation is found in some areas in association with climax types; characteristic mountain and valley forests are also present. The dominant families and genera are characteristic of the Amazon.

FAUNA The typically Amazonian fauna abounds in arthropods, birds and reptiles, but includes only limited numbers of mammals and fish.

ZONING/CONSERVATION MANAGEMENT None

STAFF At present the scientific and administrative staff of the Department of Wildlife and National Parks of the Ministry of Agriculture of Bolivia collaborates with the scientific and executive personnel of the MAB Programme in Bolivia.

LOCAL ADMINISTRATION Departmento a Silvestre, Parques Nacionales, Caza y Pesca, Ministerio de Agricultura, Casilla Correo 936, La Paz.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES No scientific research has as yet been conducted in the area. As a national park it will serve essentially as a reserve for wildlife. However, owing to its climax conditions, all manner of biological, ecological and physical research could be envisaged. While facilities are lacking at present, the road under construction along one boundary and other public works will make the area easily accessible from La Paz or Beni.

LOCAL POPULATION The only human settlement consists of a small indigenous population of Chimanes living in their traditional fashion.

MODIFICATION OF THE NATURAL ENVIRONMENT Occupation by colonizers has irreverseibly affected the condition of the park. A road linking La Paz, Alto Beni, San Borja and Trinidad has been started, and constitutes one of the boundaries of the park.

PRINCIPAL REFERENCE MATERIAL

Holz, G.S. and Bejarano, G. (In press). Final Report on the Project: Parque Nacional Pilon-Lajas. WWF Morges, Switzerland.

Reserva Nacional de Fauna "Ulla-Ulla"

BIOGEOGRAPHICAL PROVINCE 8.36.12 (Puna)

LEGAL PROTECTION Declared a National Nature Reserve for Fauna by Supreme Decree number 10070. Hunting and the destruction of flora and fauna are totally prohibited.

DATE ESTABLISHED January 1972 as a Reserva Nacional de Fauna (National Faunal Reservve) and approved as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Approximately 100 air-miles northwest of La Paz, the western boundary being the Peruvian border. 14°48'-15°16'S, 69°00'-13°21'W.

ALTITUDE 3,000-5,800m

AREA 200,000ha (reserve has an area of 300,000ha)

LAND TENURE Although as a reserve for fauna the territory is state property, certain areas in the plains belong to rural communities under the terms of the declaration concerning Agrarian Reform in Bolivia. However, this does not affect the science and technology policy for the territory.

PHYSICAL FEATURES Located in the higher parts of Bolivia, the reserve contains a combination of ecological formations including high plateaux, tundra, high cordillera, mountains, the headwaters of the Rio Euichi and Rio Turiopa, nine lakes, and a nival zone. The Apolobamba stands out as the chief mountain range along with the Cololo massif. Formations of the Yungas type, with its typical plant associations, are evolving east of the cordillera massif.

VEGETATION The area is rich in habitat diversity. There are Yungas areas in the north-east in which Gramineae such as Stipa spp. predominate, tundra areas in the high cordillera and high-mountain forest stands in parts of the western sector. Species include Distichia muscoides, Senecio spp., Calamagrostis vicunarum, Werneria spp..

FAUNA On the high plateaux and the tundra, the fauna consists mainly of Camelidae. The vicuna Vicugna vicugna (V) is particularly important, with population estimated at 2,556 (in 1984) and the alpaca Lama pacos population is 80,000. In the cordillera and the heads of valleys Odocoileus sp. and spectacled bear Tremarctos ornatus (V) can be found. Birds abound on the lakes where the predominant fish are trout (Salmonidae), which were introduced in the 1940s and are used for restocking other river basins in the interior of Bolivia. Other species include: Phyllotis spp., Lagidium spp., Chloephaga melonoptera, Plegadis ridwayi, Anas spp., Gallinula chloropus, Fulica americana, Ptilosceles resplendens.

ZONING/CONSERVATION MANAGEMENT The habitat of the vicunas is regarded as the core area, the other ecological formations being concentric to it.

STAFF One Director and six guards

LOCAL ADMINISTRATION Departmento de Vida Silvestre, Parques Nacionales, Caza y pesca, Casilla Correo 936, La Paz.

VISITOR FACILTIES The area could be an important tourist centre, but the present roads are virtually unusable.

SCIENTIFIC RESEARCH AND FACILITIES A group of visiting scientists has conducted a recent study of the pasture land. The World Wildlife Fund has contributed to the protection of the vicunas by providing cabins and a vehicle for the small number of forest rangers. Because of the variety of habitat and ecological formations, the reserve is of exceptional importance for scientific research. Access to more distant parts of the reserve is difficult because of the poor roads. There are two houses for visiting scientists.

LOCAL POPULATION The human population is estimated at 800 inhabitants of Aymaran origin, who live in small settlements in the high plateaux, which are linked by precarious routes.

MODIFICATION OF THE NATURAL ENVIRONMENT No agricultural activity is possible in any part of the zone owing to the persistent frosts and low temperatures. Consequently, the sole activity is the raising of alpacas, and to a lesser degree llamas Lama glama. As the reserve is state property, the vicunas live in complete freedom.

PRINCIPAL REFERENCE MATERIAL
The most useful scientific literature is contained in the works of Koford, Franklin and Jungius. Annual inventories are produced of the vicuna and other fauna populations.

Parc national Steneto

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The Parc national was set up in 1963 and accepted in January 1977 as a Biosphere Reserve. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection.

GEOGRAPHICAL LOCATION In the Stara Planina, 20km south of the town of Troyan, Lovech Region; 42°48'N, 24°40'E.

ALTITUDE 800-1,523m

AREA The Parc National is 3,860ha, though the Biosphere Reserve covers only 2,889ha.

LAND TENURE State government

PHYSICAL FEATURES Limestone makes up most of the underlying rock, resulting in an outstanding karst topography with bizare rock formations. The river Cherni Osam has cut a gorge about 200m deep with vertical walls. The higher areas are flatter. Caves have also been eroded in the limestone, the Koumanitsa Cave being 2,000m long while the Ptichata Doupka is 91m deep. Annual precipitation is between 937 and 1197mm with snow remaining for four months of the year. Summers are cool and humid.

VEGETATION Over much of the area there is a relatively undisturbed association of 200 year old beech Fagus sylvatica, probably the best in Europe. Another common tree is the silver fir Abies alba, and the park is a major habitat for Haberlea rhodopensis, a species endemic to the Balkans. Other species of tree include hornbeam Carpinus betulus, Ostrya carpinifolia, spruce Picea excelsa and sycamore Acer pseudoplatanus and shrubs as in the Boatin reserve.

FAUNA This is extremely rich in species diversity including brown bear Ursus arctos, chamois Rupicapra rupicapra, red deer Cervus elaphus, wild boar Sus scrofa, roe deer Capreolus capreolus, wild cat Felis silvestris, pine marten Martes martes, beech marten M. foina, otter Lutra lutra, fox Vulpes vulpes, imperial eagle Aquila heliaca, golden eagle A. chrysaetos, Saker falcon Falco cherrug, capercaillie Tetrao urogallus, hazel grouse Bonasa bonasia, long-legged buzzard Buteo rufinis, white-backed woodpecker Dendrocopus leucotos, black woodpecker Dryocopus martius and great eagle-owl Bubo bubo. The park includes 97 of the animal species protected in Bulgaria.

CULTURAL HERITAGE Some of the limestone caves are of archaeological interest.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 2,889ha; a nature reserve borders the south-east of the park, enclosing the headwaters of the Cerni Osam within the park, 80% is kept completely undisturbed, and the rest has limited access. Access to parts of the forest around the park is limited, and 80% of the park is protected from all economic and recreational activities apart from two trails through it. In the remainder, selective felling is allowed and tourists can use certain routes.

STAFF For the protection of the National Park there are three full-time workers.

LOCAL ADMINISTRATION Economie forestière, Tcherni Osam Département de Lovech.

VISITOR FACILITIES The park is accessible by road, and has great scenic beauty. Accommodation is available in Trojan, Cherni Osam and the monastery at Trojan. However, visitors are restricted to certain paths.

SCIENTIFIC RESEARCH AND FACILITIES Some studies have been made of the forest vegetation and fauna, including that of the caves but there is great potential in particular in research into the well-preserved beech forests. There is now an ecological station.

LOCAL POPULATION There is a small village just to the north-east but the immediate area is not very densely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT The lynx Lynx lynx and the wolf Canis lupus have vanished from the region as the result of uncontrolled hunting in the past. An impoundment has been made at the bottom of the canyon, but it does not disturb the forest ecosystem.

PRINCIPAL REFERENCE MATERIAL

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Alibotouch

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED A reserve 574ha was established in 1951 and a large area accepted in January 1977 as a Biosphere Reserve. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection.

GEOGRAPHICAL LOCATION In the Pirin Mountains, on the Bulgarian-Greek frontier, 41°25'N, 23°32'E.

ALTITUDE 1,150-2,200m

AREA 1,628ha

LAND TENURE State government

PHYSICAL FEATURES The reserve is situated on the side of Gotse Delchev, which reaches 2,200m and is the highest peak of Slavianka Mountain. There is a strong Mediterranean influence in the climate.

VEGETATION The reserve was set up to safeguard the Bosnian pine Pinus leucodermis, endemic to the Balkans, of which the largest area in the whole of the Balkans grows here. This pine grows in fairly pure stands or together with Austrian pine P. nigra, King Boris's fir Abies borisii-regis, European

hop-hornbeam Ostrya carpinitfolia and beech Fagus sylvatica. The reserve includes over 1400 species of plant including five endemic to Slavianka Mountain. The rare and protected species include Rhodopes tulip Tulipa rhodopea, Grisbach violet Viola grisebachiana and V. delphonantha. There is also some relict calcicolous vegetation, and the area is part of the Balkan sclerophyll biotic province. Part of the reserve is high mountain pasture while some slopes are completely barren.

FAUNA This is characteristic of Bulgarian mountain regions, including wolf Canis lupus and brown bear Ursus arctos. Eagles Aquila spp., which are depleted in other areas, can be seen.

CULTURAL HERITAGE No specific information but the area has been little disturbed by man.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 1,200ha around the reserve which also embraces the Starata Moura Reserve, about one kilometre away. Little positive management is necessary as the area is isolated. Economic and tourist activities are prohibited.

STAFF There are two permanent staff

LOCAL ADMINISTRATION Economie forestière, Gotzé Deltchev and E.F. Katuntzi, Département de Blagoevgrad.

VISITOR FACILITIES The area is isolated, and tourist activities are prohibited.

SCIENTIFIC RESEARCH AND FACILITIES The region's flora has been well studied, and partial studies have been made of its avifauna. No special facilities exist.

LOCAL POPULATION The whole area is mountainous and sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT In the past, the high-mountain forest vegetation was devastated by fire and the bearded vulture Gypaetus barbatus disappeared.

PRINCIPAL REFERENCE MATERIAL

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Bistrichko Branichté

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

ESTABLISHED The reserve was set up in 1934 and accepted in January 1977 as a Biosphere Reserve. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection.

GEOGRAPHICAL LOCATION On Mount Vitosha, just south of Sofia, 42°35'N, 23°15'E.

ALTITUDE 1,450-2,280m

AREA The Biosphere Reserve covers 1,177ha; the original forestry reserve is listed variously as 766ha, 943ha and 967ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is situated on the eastern slopes of Mount Vitosha, an extinct volcano which rises to 2,290m. It comprises the upper reaches of the catchments of the Bistritsa and Yanchevska rivers. Many of the slopes are steep, with screes and stone rivers, but interspersed with flatter areas, creating a terrace-like landscape. Rainfall varies between 850mm and 1250mm, increasing with altitude and snow-cover lasts from 80 to 200 days.

VEGETATION There are no undisturbed forests in the reserve, the oldest trees being no more than 100 years old. Half of the area has been replanted with Norway spruce Picea excelsa, scots pine Pinus sylvestris, silver fir Abies alba and white fir Pinus peuce. There is a small area of deciduous plantation, mainly beech Fagus sylvatica. The other half consists of meadows, sub-alpine and alpine grassland, and pine scrub Pinus montana occurs here, together with many interesting herbaceous plants.

FAUNA The variety of habitats and well-restored nature of forests have encouraged a varied fauna. It includes capercaillie Tetrao urogallus (rare in the region), brown bear Ursus arctos (very rare), black woodpecker Dryocopus martius, white-backed woodpecker Dendrocopus leucotos and pine marten Martes martes.

CULTURAL HERITAGE The forests on the reserve were almost completely cleared 100 years ago, probably for pasture, and it is very close to the capital, Sofia. However, the reafforestation is an excellent example of the rehabilitation of a natural landscape.

ZONING/CONSERVATION MANAGEMENT The reserve lies entirely within Vitosha National Park. Tourist access is limited to certain paths. The reafforestation was carried out with a variety of species, to create conditions as near natural as possible. There has recently been a considerable effort to restore the fauna to its original state. All economic and tourist activities are prohibited, except on a few routes.

STAFF Protection of the reserve, one full-time worker

LOCAL ADMINISTRATION Economie forestière, Conseil populaire municipal de Sofia, Secteur parcs et terrains verts, Sofia.

VISITOR FACILITIES Visitors are restricted to a few paths through the reserve itself. However, the Vitosha National Park which surrounds it was well developed facilities, including several restaurants, hotels, many kiosks and rest houses and numerous paths. On holidays the path as a whole attracts an average of 120,000 visitors from the capital.

SCIENTIFIC RESEARCH AND FACILITIES A great many scientific research projects have been carried out in Vitosha National Park, including the Biosphere Reserve. Study of the effects of human activity on the reserve would be very important since the reserve is close to a city of some million inhabitants and is often visited by tourists. There is an ecological research station nearby.

LOCAL POPULATION The reserve is within 20km of Sofia which has about a million inhabitants, although it is located in the more distant part of the national park. Nearer to the reserve, around the edge of the park, are several villages; however, the reserve itself is strictly protected.

MODIFICATION OF THE NATURAL ENVIRONMENT The coniferous forest used to be exploited, but since 1934, when the reserve was created, it has recovered its primary character to an extraordinary degree. The fauna suffered greatly in the past; the lynx, eagle, wolf and chamois have disappeared.

PRINCIPAL REFERENCE MATERIAL

Doitchef, G. (1974). La réserve Bistrichko branichté. Nachi rezervati i prirodni zavelejitelnosti, Vol. III.

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Stoyanov, N. (1938). Végétations de la réserve de Bistritza. Sbornik za zachita na prirodata. Book III.

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Boatine

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED A forestry reserve was established in 1948 and a slightly larger area accepted in January 1977 as a Biosphere Reserve. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection.

GEOGRAPHICAL LOCATION 2.5km north-east of Paskal Peak in the Stara Planina and 15km south-east of the village of Cherni Vit, Lovech Region; 42°52'N, 24°20'E.

ALTITUDE 750-1,900m

AREA An area of 1,226ha was originally designated as a forest reserve but the Biosphere Reserve encloses 1,281ha.

LAND TENURE State government

PHYSICAL FEATURES The forest lies on the northern slopes of the Stara Planina at the foot of Baba Peak, in the upper reaches of the river Cherni Vit. It is very rugged terrain, and includes the valley of the river Boatin, a tributary of the Cherni Vit. The upper boundary of the reserve reaches the high mountain pastures along the Balkan Mountains ridge. The climate is moderately continental, with comparatively warm summers, mild winters, abundant rainfall and a high relative humidity.

VEGETATION The reserve was primarily set up to preserve the primary beech Fagus sylvatica forest, 120-180 years old, which covers 90% of the reserve below 1,500m, with some trees reaching 45m in height, and a diameter of over one metre. Other species found within this forest include hornbeam Carpinus betulus, Norway maple Acer platanoides, aspen Populus tremula, juniper

Juniperus sp., elder Sambucus racemosa, hazel Corylus avellana, hawthorn Crataegus monogyna, wild rose Rosa canina and laurel Prunus laurocerasus. In higher parts of the reserve above 1,500m is spruce Picea abies forest of a more average age.

FAUNA The varied fauna includes the mammals brown bear Ursus arctos, red deer Cervus elaphus, wild boar Sus scrofa, roe deer Capreolus capreolus, wild cat Felis silvestris and pine marten Martes martes, and amongst the birds black woodpecker Dryocopus martius, white-backed woodpecker Dendrocopus leucotos, and probably capercaillie Tetrao urogallus.

CULTURAL HERITAGE The area has been little influenced by man apart from the occurrence of fire in the spruce forests which has altered their character somewhat.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 942ha. The reserve is surrounded by century-old beech forests to the north and south-west and by high mountain pastures to the south and east. All economic and tourist activities are prohibited and the reserve is well buffered by surrounding forests, so little management is required beyond enforcement of protection.

STAFF For protection of the Reserve one full-time worker

LOCAL ADMINISTRATION Economie forestière, Tcheni Vit, Département de Lovech.

VISITOR FACILITIES No tourist access to the reserve itself is allowed. Accommodation is available in the town of Teteven (30km away) and villages of Divchevoto (3km) or Cherni Vit (15km).

SCIENTIFIC RESEARCH AND FACILITIES It would be valuable to have ecological studies of the primary beech formation, probably one of the best preserved and most impressive in Europe. A road leads almost to the reserve, but there are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the creation of the reserve there was selective cutting in part of the forest. In former times the spruce forests were in great part devastated by fires caused by herdsmen. They have now regenerated naturally. The beech forest has a primary character in many places. At some time in the past the lynx Lynx lynx, the imperial eagle Aquila heliaca and the wolf Canis lupus disappeared from the region. The beeches are of great commercial value, due to their height and straightness, and it is possible that this may cause future problems.

PRINCIPAL REFERENCE MATERIAL

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Djendema

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highland)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was set up in 1953 and accepted as a Biosphere Reserve in January 1977. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection.

GEOGRAPHICAL LOCATION South of Botev Peak, the highest peak in the Stara Planina and 20km north of Kalofer, Plovdiv District. 42°47'N, 24°45'E.

ALTITUDE 1,000-2,000m

AREA 1,775ha

LAND TENURE State government

PHYSICAL FEATURES The reserve is mountainous with many steep slopes, deep chasms, caves and waterfalls which produce a picturesque landscape. It is on the southern slopes of the Kaloferska Planina and includes the upper reaches of the Bjala River.

VEGETATION The reserve was set up to protect the well preserved mixed forest of beech Fagus sylvatica, white fir Pinus peuce and Norway spruce Picea abies, which cover 12,000ha. Over half of the forest is virgin and some trees are though to be over 200 years old. There is also nearly 100ha of alpine meadow included in the reserve, while 470ha is bare rock.

FAUNA There is a varied fauna and this reserve is the only one in the Stara Planina where chamois Rupicapra rupicapra occur. Other rare animals that occur include brown bear Ursus arctos and golden eagle Aquila chrysaetos.

CULTURAL HERITAGE The reserve has been little influenced by man in the past.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone and the reserve is surrounded by pastures and forests. All economic and recreational activities are prohibited generally but a tourist route has been marked out, and staff are employed to safeguard the rest of the reserve.

STAFF For protection of the reserve, two full-time workers.

LOCAL ADMINISTRATION Economie forestière, Karlovo, Département de Plovdiv.

VISITOR FACILITIES Access is generally prohibited but there is a tourist route through the reserve and a lodge nearby. The reserve is much visited.

SCIENTIFIC RESEARCH AND FACILITIES There are no special facilities.

LOCAL POPULATION The mountain slopes have never been much settled but there are a number of small towns and villages in the larger river valleys.

MODIFICATION OF THE NATURAL ENVIRONMENT In some of the forests bordering on pasture-land there were fires in the past; in these places the effects can be seen of grazing before the reserve was established. Aegyptus monachus, Gyps fulvus and Lynx lynx have all disappeared.

PRINCIPAL REFERENCE MATERIAL
No information

Réserve Doupkata

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was set up in 1956. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the Rhodope Mountains south of the town of Batak, in the Pazardhik Region. 41°50'N, 24°15'E.

ALTITUDE 1,000-1,645m

AREA 1,210ha

LAND TENURE Government

PHYSICAL FEATURES The reserve comprises part of the valley of the river Devinska which cuts through it in a narrow gorge. The reserve boundaries follow ridges on either side of the river and the terrain is generally steep, with rock outcrops. The climate receives warm Mediterranean influences.

VEGETATION The reserve was set up primarily to conserve the pine forests, some of which are over 200 years old and 40m tall. The principal tree species is Scots pine Pinus sylvestris, but spruce Picea abies, silver fir Abies alba, beech Fagus sylvatica, aspen Populus tremula and oak Quercus dalechampii are also present. The conifer forests are over 100 years old on average.

FAUNA There is a typical Rhodope Mountain fauna, with brown bear Ursus arctos, pine marten Martes martes, badger Meles meles, fox Vulpes vulpes, capercaillie Tetrao urogallus, hazel grouse Bonasa bonasia and great eagle-owl Bubo bubo.

CULTURAL HERITAGE The area has been little influenced by man due to the rocky terrain although some disturbance of the forest has occured in the past.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 616ha. Economic and recreational activities are prohibited.

STAFF For protection two full-time workers

LOCAL ADMINISTRATION Economie forestière, Snejanka, Département de Pazardjik.

VISITOR FACILITIES There are no special facilities and tourist access is prohibited. However, there is a cart road, which is occasionally used, through the reserve.

SCIENTIFIC RESEARCH AND FACILITIES Study of the seral communities of Populus tremula passing into the climax association of Pinus sylvestris, Picea abies and Abies alba would be of interest. There are no scientific facilities, but lorry roads pass not far from the reserve, and a cart road through it.

LOCAL POPULATION There are several small villages nearby but the area is remote, being near the Greek border.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created, there was selective cutting and extraction of resin in the forest, parts of which had been devastated by fires lit by shepherds. Lynx lynx, Canis lupus and probably Rupicapra rupicapra have disappeared from the region, but, because of the steep, rocky terrain, the ecosystem has largely preserved its primitive character.

PRINCIPAL REFERENCE MATERIAL

Nochtev, V. (1974). La Réserve Doupkata. Nachi rezervati i prirodni zabelejitelnosti, Vol. III.

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Doupki-Djindjiritza

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Malka Djindjiritza was established in 1947; Baiuvi Doupki was established in 1934 as forestry reserves. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. All are included in the Biosphere Reserve which was set up in 1977.

GEOGRAPHICAL LOCATION South-east of the town of Razlog in the Blagoevgrad Region on the northern slopes of Mount Pirin. 44°48'N, 23°25'E.

ALTITUDE 1,200-2,884m

AREA The Biosphere Reserve covers 2,873ha and includes two reserves, Baiuvi Doupki, set up as 1,450ha (one source list 850ha) and Malka Djindjiritza, 339ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is on the northern slopes of Mount Pirin, an impressive granite horst 2,915m high. There are glacial features including cirques, some with lakes. Parts of the area are limestone with deep ravines while some of the limestone has been metamorphosed to form marble. There are many waterfalls, rapids and springs. Climate varies considerably with altitude but is generally cool, and snow cover remains for five to eight months on higher parts of the mountain.

VEGETATION The reserve was set up to protect the ancient forests of white fir Pinus peuce black fir P. leucodermis, and the alpine vegetation. In some of the more inaccessible areas many of the trees are over 500 years old, and may measure up to 45m, with a girth of 2m. Vegetation of the area is in fact extremely varied for an area of conifer forest partly due to the range of altitudes, and all the conifers found in Bulgaria are represented here, with Corsican pine P. nigra, Picea abies, fir Abies alba, P. heldreichii, Scots pine P. sylvestris and pine-scrub P. montana. Such conifer forests occupy 20% of the reserve, the only deciduous species being beech Fagus sylvatica. The genetic resources of the Pirin mountain are unique and their conservation

important. The remaining area is covered by formations of pine-scrub and alpine areas. The alpine vegetation is particularly rich and varied, boasting a luxuriant calcicole vegetation, edelweiss Leontopodium alpinum (rare in Bulgaria), and many neo-endemic species.

FAUNA This includes the brown bear Ursus arctos, chamois Rupicapra rupicapra, golden eagle Aquila chrysaetos, roe deer Capreolus capreolus, wild goats and many others which are typical of the forests or alpine areas.

CULTURAL HERITAGE The reserve has remained little disturbed by human activities.

ZONING/CONSERVATION MANAGEMENT The reserve is contained entirely within the Pirin National Park, which acts as a buffer zone. All economic and recreational activities are prohibited. Extra guards are taken on in summer to minimise tourist pressure, and visitors are restricted to certain paths.

STAFF One permanent member of staff; volunteer guards during the summer

LOCAL ADMINISTRATION Economie forestière et Razlog, Bansko, Département de Blagoevgrad.

VISITOR FACILITIES The Pirin National Park is popular with visitors from home and abroad and visitors may walk through the Biosphere Reserve. There is accommodation available in Razlog, 18km away. There is a surfaced road to the reserve which can be approached by bus or on foot.

SCIENTIFIC RESEARCH AND FACILITIES Studies of the regional flora are nearing completion; ecological studies of the chamois have also been undertaken. It would be of scientific value to study the reserve's relict forests and the formation of contemporary floristic species. No scientific facilities are available, but a macadam road goes near the reserve.

LOCAL POPULATION The higher slopes of Mount Pirin are too cold and rugged to encourage habitation, but there are many small villages in the river valleys around its base and on the lower slopes.

MODIFICATION OF THE NATURAL ENVIRONMENT No information

PRINCIPAL REFERENCE MATERIAL

Alexandrov, A. and Velkov, D. (1985). Pirin Mountain as a gene pool of coniferous tree species in Bulgaria. In: International Symposium: Conservation of Natural Areas and of the Genetic Material they Contain. Project 8 on the programme 'Man and Biosphere' of Unesco. Unesco: Blagoevgrad.

Stoilov, D., Noshtev, V. Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Kamtchia

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1951. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION At the mouth of the Kamtchia river on the Black Sea, south of the city of Varna, 43°02'N, 27°50'E.

ALTITUDE 0-4m

AREA The original reserve covered 525ha but the Biosphere Reserve includes 842ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is on the floodplain of the River Kamtchia, at its mouth. Soils are formed predominantly of alluvium, and are flooded twice a year by the river's spring and autumn flood.

VEGETATION The reserve includes the remains of forests which once covered over 5,000ha. This flood forest is dominated by Fraxinus oxyphylla and Quercus pedunculiflora with Crataegus monogyna among the understorey plants. Many of the trees are over 35m in height and are about 120 years old. Climbing plants are common, including Similax excelsa, Periploca graeca, Vitis silvestris, Hedera helix and Clematis vitalba. Along the river banks there are marshes and rushes.

FAUNA There is a variety of terrestrial and aquatic animals. Mammals include roe deer Capreolus capreolus, wild boar Sus scrofa, pine marten Martes martes and fox Vulpes vulpes. There are many reptiles and amphibians, including European mud turtle Emys orbicularis, tessellated water snake Natrix tessellata and alligator lizard Ophisaurus apodus. Birds include a small colony of little egrets Egretta garzetta and the rare half-collared flycatcher Ficedula albicollis semitorquata. Many waterbirds nest along the river banks. Over 20 species of fish live in the river.

CULTURAL HERITAGE The area has been subject to cutting and drainage attempts.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone. From north to west stretch forests and tillable lands, while to the east a ribbon of coastal sand and biocenoses of Paliurus aculeatus have not been developed as tourist resorts. The reserve is strictly protected and all economic activities prohibited. Access by visitors has been controlled by fencing the most vulnerable side.

STAFF One full-time forest guard

LOCAL ADMINISTRATION Economie forestière, Staro Oryakhovo, Département de Varna.

VISITOR FACILITIES Boats may be hired from fishermen at the mouth of the river, but access is limited.

SCIENTIFIC RESEARCH AND FACILITIES Comprehensive ecological studies and permanent research into the effects of human activity are indispensable. This is the only flood forest area in Bulgaria where such research can conveniently be carried out, and probably one of the few in Europe. There is no scientific research station.

LOCAL POPULATION There is a small village at the mouth of the river but the floodplains are fairly populated.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created there was selective cutting and also all the trees of Ulmus campestris, which had been struck by Graphium ulmi (1930-35), were cut down. An embankment was partially built on the right bank of the Kamtchia River which narrowed the front of the flood-rise as it entered the reserve, and it is thought that this caused some disturbance to the forest's hydrological regime. The fact that the area is now a strict reserve is helping the flood forest to recover its original character.

PRINCIPAL REFERENCE MATERIAL

Stoilov, D., Noshtev, V., Gerasimov, S. and Velev, V. (1981). Protected Natural Sites in the People's Republic of Bulgaria. Balkan State Printing House: Sofia.

Réserve Koupena

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1961. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the Rhodope mountains, 2km south of the town of Peshtera, in the Pazardzhik Region, 42°05'N, 24°20'E.

ALTITUDE 650-1,410m

AREA The original reserve is listed variously as being 818ha, 905ha and 963ha but the Biosphere Reserve incudes 1,084ha.

LAND TENURE State government

PHYSICAL FEATURES This ia a mountainous region, part of the Bataska Planina.

VEGETATION The vegetation is characteristic of the Rhodope Mountains. Pure beech Fagus sylvatica and mixed beech and silver fir Abies alba predominate but there are 12 tree species in all, including scots pine Pinus silvestris, oak Quercus dalechampii and black pine P. nigra. Many trees are over 130 years old.

FAUNA There is a varied fauna, including brown bear Ursus arctos, wild cat Felis silvestries, pine marten Martes martes and chamois Rupicapra rupicapra.

CULTURAL HERITAGE Reservoirs on streams and selective cutting were the main impact of man in the past.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 1,358ha.

STAFF Three men for reserve protection

LOCAL ADMINISTRATION Economie forestière, Péchtéra, Département de Pazardjik.

VISITOR FACILITIES There are no facilities and access is restricted. However, there is road through the reserve, and other attractions in the area, like the Snezhanka Natural Monument to the north-east.

SCIENTIFIC RESEARCH AND FACILITIES Little research has been carried out. It would be of interest to undertake comprehensive studies of the ecology of the reserve; studies of the development of relatively young coppice under ideal growth conditions; and studies of the chamois and bear populations, including the behaviour of these two species when living close to human communities. There are no scientific facilities in the reserve, but there are no problems regarding access.

LOCAL POPULATION Sparse in the immediate surroundings but several towns within 10km.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created, there had been selective cutting in the forest; a lorry road had also been built which is now used only for through-traffic, and a few reservoirs have been formed on certain streams.

PRINCIPAL REFERENCE MATERIAL
None listed

Réserve Mantaritza

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED January 1977 as a Biosphere Reserve

GEOGRAPHICAL LOCATION North of Golyama Syutka Peak in the Rhodope Mountains, and south of the town of Rakitovo in the Pazardzhik Region, 41°58'N, 24°02'E.

ALTITUDE 1,400-1,900m

AREA 576ha

LAND TENURE State government

PHYSICAL FEATURES The reserve is situated on the north-east facing slopes of the Bataska Planina.

VEGETATION The reserve is in the Bulgarian Floristic Sub-Region of West Rhodope (Rhodope Floristic Region) and is part of the Central European mountain biotic province. There are century-old forests of pure and mixed stands of Norway spruce Picea abies, beech Fagus sylvatica and silver fir Abies alba, which have a primary character.

FAUNA The varied fauna includes brown bear Ursus arctos, red deer Cervus elaphus, roe deer Capreolus capreolus, wild boar Sus scrofa, pine marten Martes martes, badger Meles meles, fox Vulpes vulpes, capercaillie Terao urogallus, hazel grouse Bonasa bonasia, black woodpecker Dryocopus martius and crested tit Parus cristatus.

CULTURAL HERITAGE There has been some disturbance of the forest ecosystem, but this area has been affected little by man.

ZONING/CONSERVATION MANAGEMENT No special buffer zone exists, but the region is surrounded by forests and catchment zones closed to access. All tourist and recreational activities are prohibited except there is a tourist path through the reserve.

STAFF Two men are employed full-time, to protect the reserve.

LOCAL ADMINISTRATION Economie forestière, Rakitovo, Département de Pazardjik.

VISITOR FACILITIES The reserve has restricted access and tourists are only allowed to use one path through the reserve. A main road runs nearly to the water and accommodation is available in towns about 10km away.

SCIENTIFIC RESEARCH AND FACILITIES Partial silvicultural studies have been undertaken. There are no special facilities.

LOCAL POPULATION The mountains are sparsely populated but there are several towns and villages in the lower river valleys, within 20km.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created there had been small-scale selective cutting and also the construction of reservoirs. However, the hydrological regime of the forest is unlikely to have been substantially disturbed because of the abundant springs.

PRINCIPAL REFERENCE MATERIAL
None listed

Réserve Maritchini ezera

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1956. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the Rila Mountains, on the slopes of Mussala Peak, the highest mountain in the Balkans; 42°14'N, 23°35'E.

ALTITUDE 1,800-2,925m

AREA 1,510ha

LAND TENURE Government

PHYSICAL FEATURES The terrain is mountainous, and the reserve includes the summits of several peaks, including Mussaloc, the highest in Bulgaria. It encloses the headwaters of the river Maritza and there is a circle of lakes, the Maritchini.

VEGETATION This consists mainly of alpine meadows and dwarf mountain pine Pinus mugo var. mughus. There are also small forests of white fir P. peuce, scots pine P. sylvestris and Norway spruce Picea abies. There are many relict and endemic plants, including Rila primula Primula deorum, endemic to the Rila mountains.

FAUNA The varied fauna includes brown bear Ursus arctos, roe deer Capreolus capreolus and golden eagle Aquila chrysaetos. The lakes abound with mountain trout Salmo trutta fario.

ZONING/CONSERVATION MANAGEMENT A buffer zone is projected. To the east is a catchment zone where public access is prohibited. The area is remote and little active management is required.

STAFF One man

VISITOR FACILITIES No information

LOCAL ADMINISTRATION Economie forestière, Borovets, Département de Sofia.

LOCAL POPULATION The mountainous surroundings are very sparsely populated. There are a few villages in the lower river valleys to the north and the town of Samokov is 20km away.

MODIFICATION OF THE NATURAL ENVIRONMENT Due to its isolation and high elevation, the reserve has not been substantially modified.

PRINCIPAL REFERENCE MATERIAL
None listed

Réserve Ouzounboudjak

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1956. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION On the Turkish border in the Strandzha Planina, on the Rezvaya River, south of the village of Kosti, 42°00'N, 27°45'E.

ALTITUDE 150-200m

AREA The original reserve had an area of 2,529ha but the Biosphere Reserve encloses 2,575ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is on the left bank of the River Resvaja, which forms the boundary on two sides. The terrain is hilly and the climate has marked maritime influences, being ony about 20km from the sea.

VEGETATION The reserve was set up to preserve the oak Quercus polycarpa and Q. frainetto and beech Fagus orientalis forests which are over 200 years old. The understorey includes Rhododendron ponticum, Daphne ponticum, Vaccinium arctostaphylos and Mespilus germanica, some of which only grow naturally in Europe in the Strandzha. It is in the Bulgarian Floristic Region of Strandzha and part of the Balkan sclerophyll biotic province.

FAUNA This is rich and varied and includes wild boar Sus scrofa, roe deer Capreolus capreolus, wild cat Felis silvestris, badger Meles meles, red fox Vulpes vulpes and pine marten Martes martes while wolf Canis lupus occasionally come from Turkey.

CULTURAL HERITAGE The reserve is on the Turkish border, and is remote. Part of the area was selectively logged, but man has affected it very little.

ZONING/CONSERVATION MANAGEMENT A buffer zone is projected. The reserve is strictly protected and all economic and tourist activities prohibited.

STAFF One permanent member of staff

LOCAL ADMINISTRATION Economie forestière, Kosti, Département de Bourgas.

VISITOR FACILITIES Access for tourism is prohibited. The area is remote, in a border region and there are no facilities.

SCIENTIFIC RESEARCH AND FACILITIES There has been little scientific research and there are no special facilities.

LOCAL POPULATION This border zone is very sparsely populated; there is a village at the mouth of the Resvaja River.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created there was successive selective cutting over a third of the area. Strandzha has seen the disappearance of Ursus arctos, Lynx lynx, Gypaetus barbatus and other fauna.

PRINCIPAL REFERENCE MATERIAL
No information

Réserve Parangalitza

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1933. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Below Ezernik Peak, on the southern side of the Rila Mountains in the Blagoevgrad Region, 42°15'N, 23°15'E.

ALTITUDE 1,400-2,485m

AREA 1,509ha

LAND TENURE Government

PHYSICAL FEATURES The reserve is situated in high mountain country, and includes the headwaters of the Bistritza River to the east, the border of the reserve follows the main ridge of the Rila massif with four peaks over 2,400m in height. The reserve's northern and southern borders follow the Bistritsa and Gaidushka rivers to their confluence in the west. The second and third denudation outcrops from the Rila massif extend into the reserve.

VEGETATION The reserve was set up to preserve the undisturbed primary forests, particularly the Norway spruce Picea abies and various pines. It includes about 400ha of the oldest conifers in Bulgaria, 150-350 years old. These trees are up to 50m high, over a metre in diameter and there is an average of 1600 cu.m. per ha of timber. The remainder of the reserve has alpine and sub-alpine scrub.

FAUNA The fauna is representative of undisturbed forest and includes brown bear Ursus arctos red deer Cervus elaphus, wild cat Felis silvestris, chamois Rupicapra rupicapra, pine marten Martes martes and golden eagle Aquila chrysaetos.

CULTURAL HERITAGE The reserve has been little affected by man.

ZONING/CONSERVATION MANAGEMENT A buffer zone is projected; the reserve is surrounded by forest and high mountain pastures. The area is strictly protected and all economic and tourist activities are prohibited.

STAFF One biologist and one full-time worker

LOCAL ADMINISTRATION Economie forestière, Blagoevgrad.

VISITOR FACILITIES Tourist access is prohibited and there are no facilities. However, the area can be reached by surfaced road from Blagoevgrad, 35km to the west, which has accommodation.

SCIENTIFIC RESEARCH AND FACILITIES Research has been undertaken on the game animals, vegetation and flora of the reserve, and includes silvicultural studies. There is an ecological research station

LOCAL POPULATION Few people live in the immediate surroundings, which are mountainous, but the town of Blagoevgrad is located 35km to the west.

MODIFICATION OF THE NATURAL ENVIRONMENT There has been no substantial modification, of the natural environment.

PRINCIPAL REFERENCE MATERIAL

Penev, P. and Penev, I. (1968). La réserve Parangalitza. Nachi rezervati i prirodni zabelejitelnosti, Vol. I.

Réserve Srebarna

GEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED The area was declared a wildfowl refuge in 1942 and established as a Nature Reserve by the Ministry of Agriculture and Foods, 20 September 1948, Decree No. 2-11-931. It was accepted in 7 March 1974 as a World Heritage Site, on 24 September 1975 as a Ramsar site and in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Srebarna Lake is located on the Danube flood plain, 19km west of the town of Silistra in Silistra province, 1km south of the Danube (which forms the border with Romania). 44°05'N, 27°07'E.

ALTITUDE Approximately 100m

AREA 600ha

LAND TENURE State government

PHYSICAL FEATURES This 1.5m long freshwater lake is situated on the flood plain of the river Danube, to which it was connected until 1949. This caused the lake level to sink by over a metre per year and it was reconnected by canal in 1978. The land in the immediate surroundings is marshy, but just beyond the boundaries are low hills.

VEGETATION Srebarna is the only natural tract of land of any considerable extent to be protected in north-eastern Bulgaria, a floristic region of the Ukraine-Kazakh biotic province. Plants include the reed community Phragmites communis which occupies two thirds of the reserve and form a thick barrier around the lake, water lily Nymphaea alba and a number of rare marsh plants.

FAUNA The reserve was set up primarily to protect the rich avifauna, nearly 180 bird species (half of the Bulgarian avifauna), including 80 migratory species. There are 99 breeding species, including the only Bulgarian colony of Dalmatian pelican Pelecanus crispus (V) (50-100 pairs), white-tailed eagle Haliaeetus albicilla (V) (one pair), glossy ibis Plegadis falcinellus (50-5000 pairs), white spoonbill Platalea leucorodia (three-ten pairs) and little cormorant Phalacrocorax pygmaeus (20 pairs). The reserve is the only nesting place in Bulgaria for the great egret Egretta alba (ten-15 pairs), and there are five other species of heron with some 1000 nests. Others species include mute swan Cygnus olor, a variety of geese Anser anser, A. erythropus, and Branta ruficollis, and ducks Anas strepera, Aythya nyroca, Tadorna ferruginea, and Netta rufina; red necked grebe Podiceps griseigena; two of the three European species of marsh tern Chilidonias nigra, and C. hybrida; bluethroat Luscinia svecica; and bearded tit Panurus biarmicus. Otter Lutra lutra (V) is occasionally found in the reserve.

CULTURAL HERITAGE The main impact from man was through drainage schemes, but this has now been largely reversed.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 575ha. A project was initiated in 1978 to reconnect the lake with the Danube to prevent water levels becoming too low and to restore the lake's fish population. Access is strictly controlled to scientific staff with permits and shooting prohibited. The reserve is well fenced. A management decree was issued in 1962. There has been discussion about establishing a joint nature reserve with Romania, including both banks and the islands of the Danube.

STAFF This includes two guards, two biologists and technical personnel

VISITOR FACILITIES No information

LOCAL ADMINISTRATION Committee for the Environmental Protection at the Council of Ministers of P.R. of Bulgaria (Administrative); Research and Coordination Centre for the Protection and Restoration of the Environment, B.A.S. (Scientific).

SCIENTIFIC RESEARCH AND FACILITIES Only carefully controlled scientific research is allowed. There is continuous research, mainly to establish the numbers of the different species and the ecological conditions necessary for their long-term preservation. There is a natural history museum and ecological field station, at Srebarna Village.

MODIFICATION OF THE NATURAL ENVIRONMENT The site is relatively small so numbers of breeding pairs of birds are low and probably insufficient to maintain any of the species. Muskrats Ondatra zibethica, from central Europe, which are also to be found along the Bulgarian reaches of the Danube, became naturalised in the lake area in 1956.

PRINCIPAL REFERENCE MATERIAL

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Réserve Tchervenata sténa

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1962. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These

are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Above Vachkovo Monastery, 18km south of Asenovgrad in the Plovdiv Region. 41°52'N, 24°45'E.

ALTITUDE 400-1,500m

AREA The original reserve had an area of 581ha but the Biosphere Reserve encloses 812ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is part of a karstic marble massif, characterized by steep slopes and deep ravines with modified Mediterranean climatic conditions. There are many interesting rock formations.

VEGETATION The reserve was mainly set up to safeguard the large number of rare, endemic and relict plants found here. It is in the Bulgarian floristic sub-region of Eastern Rhodope (Rhodope Floristic Region), and is part of the Central European mountain biotic province. There are Sub-Mediterranean forest cenoses, predominantly associations of Pinus nigra, with Abies alba in places and vestiges of relict Ostrya carpinifolia, and Quercus pubescens. There are also associations of beech Fagus sulvatica. The many relicts and palaeoendemic species include Cypripedium calceolus, Daphne laureola, Syringa vulgaris, Lathrea rhodopaea, Morina persica, Haberlea rhodopensis, Scaviosa rhodopensis, and Trachelium rumelianum. Neo-endemic species include Pulsatilla rhodopaea, Verbascum decorum, Inula aschersoniana, Linum rhodopaeum, and Carum graecum.

FAUNA This is typical of the region

CULTURAL HERITAGE The reserve has been little affected by man's activities, especially the higher parts.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of 330ha

STAFF One man

LOCAL ADMINISTRATION Economie forestière, Assenovgrad, Département de Plovdiv.

VISITOR FACILITIES All tourist activities are prohibited and the reserve is remote.

SCIENTIFIC RESEARCH AND FACILITIES There have been several studies of the flora. The relict forests of Pinus nigra and Ostrya carpinifolia and the rare species, among which there are many endemic Bulgarian forms, are of international scientific interest. There are no scientific facilities; a tarred road goes as far as Bachkovo Monastery.

LOCAL POPULATION The surrounding areas area sparsely populated but the town of Asenovgrad is less than 20km away.

MODIFICATION OF THE NATURAL ENVIRONMENT The lowest parts of the reserve show traces of marked human influence in the near and distant past, as a result of which eastern hornbeam Carpinus orientalis has become established

secondarily. The cenoses of Pinus nigra and Abies alba are well preserved, with the greatest number of relicts and endemic forms.

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Réserve Tchoupréné

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established in 1973. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In north-west Bulgaria, on the Yugoslav frontier, 4km north of Mijur Peak. 43°43'N, 22°30'E.

ALTITUDE 1,400-2,000m

AREA The reserve originally set up had an area of 937ha but the Biosphere Reserve encloses 1,440ha.

LAND TENURE Government

PHYSICAL FEATURES The entire reserve lies on the northern slopes of the Stara Planina.

VEGETATION The reserve was set up to conserve the natural forests of Norway spruce Piecea abies. It is in the Bulgarian Floristic Sub-Region of Western Stara Planina (Stara Planina Floristic Region), in the Central European mountain biotic province. This sub-region shows the most pronounced influence of Central European vegetation. There is primary forest, about 100 years old, the only spruce forest and the largest area of forest in the Stara Planina.

FAUNA The reserve is the only habitat in Stara Planina of considerable size for Capercaillie Tetrao urogallus (almost 40 or 50 birds). Red crossbill Loxia curvirostra and nutcracker Nucifraga caryocatactes also occur, both rare in Stara Planina.

CULTURAL HERITAGE The area is very remote and little affected by man.

ZONING/CONSERVATION MANAGEMENT No buffer zone has been designated although there is a protected catchment to the north. The national frontier is to the south.

STAFF Three full-time workers for protection of the reserve.

LOCAL ADMINISTRATION Economie forestière, Tchoupréné, Départmenet de Vidine.

VISITOR FACILITIES None

MODIFICATION OF THE NATURAL ENVIRONMENT No information

PRINCIPAL REFERENCE MATERIAL

Nankinov, D. and Dzhuninski, E. (1985). In Vol. III International Symposium Conservation of Natural Areas of the Genetic Material they contain. Sofia. Pp. 45-55.

Réserve Tsaritchina

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was set up in 1956. The Union for Nature Protection set up in 1928 was responsible for setting up many reserves. These are now protected under the 1967 Law on Nature Protection. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Immediately north of Vezhene Peak in the Stara Planina, about 15km south of the village of Ribaritsa, Lovech Region. 42°50'N, 24°30'E.

ALTITUDE 1,200-1,950m

AREA The original reserve is variously listed as 472ha, 617ha and 1,143ha, but the Biosphere Reserve encloses 1,420ha.

LAND TENURE Government

PHYSICAL FEATURES The reserve is on the northern slopes of the Central Stara Planina. The terrain is steep. Brown forest soils predominate, but there are also montane forest soils regarded as endemic to Bulgaria. Annual precipitation is about 1200mm and a covering of snow lasts 120 days of the year. Average annual temperature is only 5°C.

VEGETATION Two main groups of forest-vegetation associations are present: beech Fagus sylvatica and silver fir Abies alba, and white fir Pinus peuce and spruce Picea abies. The Balkan species Pinus peuce (a Tertiary relict) occupies over 20% of its area; the reserve is the only place where this species is found in the Stara Planina and is its most northern habitat in Europe.

FAUNA There is varied fauna, including brown bear Ursus arctos, red deer Cervus elaphus, wild boar Sus scrofa, roe deer Capreolus capreolus, pine marten Martes martes, beech marten M. foina, wild cat Felis silvestris, great eagle-owl Bubo bubo, hazel grouse Bonasa bonasia, black woodpecker Dryocopus martius, white-backed woodpecker Dendrocopus leucotos and red crossbill Loxia curvirostra. More than 60 bird species nest in the reserve.

CULTURAL HERITAGE There has been some encroachment by shepherds, which has disturbed the forest in some areas.

ZONING/CONSERVATION MANAGEMENT The reserve has a buffer zone of 1,062ha. To the east and south there is a protected water catchment; to the north and west, old forests. All economic and tourist ativities are prohibited although there are two tourist routes through the reserve.

STAFF There are four full-time workers for the reserve protection.

LOCAL ADMINISTRATION Economie forestière, Ribaritza, Département de Lovetch.

VISITOR FACILITIES Two paths are marked through the reserve but it is generally closed to the public.

SCIENTIFIC RESEARCH AND FACILITIES Some silvicultural research and ornithological observations have been carried out. Study of Pinus peuce would be of international interest, since this woody species, though a Tertiary relict, displays exceptional aggressiveness in re-invading unwooded terrain, gradually re-establishing its former upper distribution limits. Comprehensive ecological studies would also be of great scientific interest, especially once the reserve is enlarged by incorporation of sub-alpine pastures and orophyte habitats. There are no special facilities.

LOCAL POPULATION The area is generally fairly sparsely populated and there are only a few small villages in the river valleys at the foot of the Stara Planina.

MODIFICATION OF THE NATURAL ENVIRONMENT Shepherds had formerly burned down the Pinus peuce and Picea abies forests to enlarge their pastures, but over the past 50 to 70 years the forest has naturally regenerated. Before the reserve was created there was selective cutting in the beech forests, but they are fast regaining their primary character. About 50 years ago the lynx Lynx lynx vanished from the region, as did the imperial eagle Aquila heliaca, though this has recently reappeared.

PRINCIPAL REFERENCE MATERIAL

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Berezinsky State Reserve

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Middle European Forest)

LEGAL PROTECTION Total. In accordance with the basic principles of land legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is prohibited both in the territory of a reserve and within the protected zones set up around reserves.

DATE ESTABLISHED Created by order of Council of People's commissars of Byelorussian SSR in 1925 and approved as a Biosphere Reserve in April 1978.

GEOGRAPHICAL LOCATION Situated in the Vitebsk oblast' (northern 60% of the reserve) and Minsk oblast' (southern 30% of the reserve) of the Byelorussian SSR on the Verkhneberezinski lowlands 83km north-east of Minsk. 54°38'N, 28°21'E.

ALTITUDE 120-250m

AREA 76,201ha in total

LAND TENURE State property, under the administration of the USSR Ministry of Agriculture.

PHYSICAL FEATURES The reserve is situated along the upper course of the river Berezina which has at least six inflowing tributaries with the reserve. Geomorphologically it can be divided into several zones: terminal moraines; low-lying, gently rolling areas of thick sands; flat, very low flood plain of the river Berezina; and a boggy and peaty lowland-basin. Individual blocks of bogs occupy extensive areas - from 2,000-3,000 to 11,000ha. Hydrographically, the territory of the reserve belongs to the basin of the river Berezina which is a large tributary of the Dnepr. The next large water main is the Ol'shitsa-Plavno-Manets lake system linking up through the Serguch Canal with the river Bereziba and through the Berenzina Canal with the West Dvina River. The climate is continental temperate with high humidity. The mean annual rainfall is 780mm. The duration of snow cover is 100-120 days. Temperatures reach 33°C in the summer and -36°C in the winter, but average -7.0°C in January and 17.8°C in July.

VEGETATION The reserve consists of 63,507ha of forest, 977ha of meadows and 1,759ha of water bodies (Lake Palik and three others). The reserve belongs to the subzone of broadleaved and spruce forests of the Russian plains and represents the north European coniferous and broadleaved forest and wetland types. The afforested area covering 83.6% of the area, includes about 30 types of woodland. The most widespread of the predominant species are pine (42%), spruce (11%), birch (23%) and black-alder (18%) forests with areas of oak, ash, and lime. Among the non-forest areas are swamps and meadows of three types. 906 species of flowering and higher sporophytic plants are present, belonging to 359 genera and 100 families (excluding the mosses), and including 38 rare and vanishing plant species. Relict of the Ice Age include dwarf birch Betula nana, Linnaea borealis and coral-wort Corallorhiza trifida.

FAUNA 295 species of vertebrates have been recorded in the reserve, including 52 mammals, 205 birds (152 nesting, 38 passage, six wintering and nine accidental migrants), five reptiles, eight amphibians and 33 species of fish. The principal and most valuable species of animals are beaver Castor fiber, elk Alces alces, wild boar Sus scrofa, roe deer Capreolus capreolus, bear

Ursus arctos and wolf Canis lupus, lynx Lynx lynx and of the birds, capercaillie Tetrao urogallus, hazel hen Tetrastes bonasia, black Ciconia nigra and white C. ciconia storks. Thirty-four species of fish.

ZONING/CONSERVATION MANAGEMENT In 1976, the reserve was divided into two zones: a core area of 34,267ha (45%) and a buffer zone of 41,395ha (55%). At present there is strict protected zone (core area) (35,000ha), a buffer zone, (30,000ha) a visitor and recreation zone (which includes a museum, zoo-park and arboretum) and an experimental farming zone (7,000ha). There is a protection belt around the reserve of 1-2km. The reserve was originally established to protect valuable wild game birds and fur bearing animals such as beaver. This was further prompted by the extensive deforestation of Byelorussia during World War I. The conservation management is being tightened up by reducing the agricultural area, concentrating the inhabited zones and closing roads inside the reserve.

STAFF 270 staff. Permanent accommodation and administrative centre is at Domzhesitsy village.

LOCAL ADMINISTRATION P.O. Domzheritsy, Lepel' District, Vitebsk Region, Byelorussian SSr, USSR, 211188.

VISITOR FACILITIES There is a visitor and recreation zone southwards from Domzheitsy village.

SCIENTIFIC RESEARCH AND FACILITIES A fully equipped multi-disciplinary scientific research institute was established in the 1960s. From 1961 to 1970 the main investigations undertaken were of abiotic conditions - study of the typology of the forests and swamps, and the hydrological regime of the territory. In 1971-1975, research was aimed at drawing up an inventory of the natural objects of the reserve, and working out measures for the protection and reproduction and natural resources in the biogeocenoses of the reserve. Attention was focused on the ecology and biology of individual species and the main forest ecosystems. The reserve is situated close to the Minsk-Vitebsk highway and has a network of roads for internal use. The US-USSR 'Cooperation in the Field of Environment Protection' has involved bilateral research projects with the Berezinsky reserve being twinned with the Isle Royal National Park in the US and exchange visits of scientists. In 1982 US scientists visited the reserve, to compare methodologies. Currently global, regional and local scale monitoring takes place with daily measurements of dust content, sulphur dioxide, mercury, lead, cadmium, arsenic and carbohydrates are made as appropriate in the atmosphere, rainfall soil and plant. The impact of agriculture and drainage on the wetlands and woodlands is a major research topic. In 1979 the reserve commenced research in three themes - Theme 2, 8 and 14.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the reserve was created, its territory was man-modified. All economic activities are now prohibited in the core area, but not in the buffer zone.

REFERENCES Publications of Berezinsky Biosphere Reserve include Berezinsky Biosphere Nature Reserve of the Byelorussian SSR, Beavers of Berezinsky Nature Reserve, Natural History Museum at Berezinsky Biosphere Nature Reserve, Rare and Vanishing Animals of the Berezinsky Biosphere Nature Resrve, Zoological Studies in Berezinsky Biospheric Nature Reserve and Ecological Studies of Forests in the Berezinsky Biosphere Nature Reserve and Field Trip Guide Route (sic): Minsk-Berezinsky Biosphere Reserve.

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Parc national de Waza

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Total

DATE ESTABLISHED 5 December 1968 as Parc national de Waza by Arrête No. 120. Established 24 March 1934 (Arrête No. 71) as a hunting reserve with the name of Zina-Waza. Enlarged from 155,000ha to 165,000ha by Arrête No. 264 of 9 September 1935, and then raised to the level of forest and faunal reserve by Arrête No. 297 of 30 July 1938. Approved as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION Near Lake Chad (Ndjamena) in the Department of Logone and Chari, Northern Province. 90km south of Kousseri. 11°00'-11°30'N, 14°30'-14°75'E.

ALTITUDE Average 300-320m, rising to 500m

AREA 170,000ha

LAND TENURE Government

PHYSICAL FEATURES The park lies in the Chad depression in an area of low relief with no permanent rivers. Part of the area was once covered by Lake Chad. Sand dunes in the west indicate that this area was once desert. The rocky outcrops around Waza village rise to over 500m and are probably fairly important, having effects on soil formation and temperature buffering in particular. Soils are mainly ferruginous tropical with various catenas, hydromorphic soils and vertisols. The dry season is from October to May. Rainfall is irregular, with an annual mean of 700mm. Mean annual temperature is 28°C. December is coolest, with mean monthly minimum of 16°C and maximum of 33°C. April, just before the rains, has a mean monthly minimum of 21°C and maximum of 41°C.

VEGETATION There are five main vegetation types: (1) Open combretaceous shrub savanna with Sclerocarya birrea tree savanna, Combretum spp. and Terminalia spp. shrubs and stands of palm Hyphaene thebaica. The soil is sandy, with a sparse ground cover, burnt annually to prevent late accidental fires which are difficult to control. (2) Anogeissus leiocarpus woodland on sandy soil with absence of young trees due to annual fires. (3) Lannea humilis open grass savanna with short annual grasses, sparse trees and stands of Mitragyna inermis forming small islands around temporary waterholes. The soil is compact clay, which is very saline due to high evaporation. (4) Acacia seyal tree savanna on black clay soils which are saturated with water in the rainy season. Perennial grasses are absent. This vegetation type is slowly spreading as the area gradually dries out. (5) Yaéré floodplains with perennial grasses such as Vetiveria nigritana, Oryza barthii, Echinochloa pyramidalis and E. stagnina and some herbaceous legumes including Sesbania pachycarpa. Trees are absent and fires common. The floodplains are vital to the carrying capacity of the Waza region as the perennial grasses last long into the dry season.

FAUNA The fauna is rich and varied with large numbers of giraffe Giraffa camelopardalis (increasing with the spread of Acacia woodland), elephant Loxodonta africana (T), aardvark Orycteropus afer, warthog Phacochoerus aethiopicus, hyena Hyaena hyaena, lion Panthera leo, red-fronted gazelle Gazella rufifrons, waterbuck Kobus ellipsiprymnus, kob K. kob, topi Damaliscus lunatus, roan antelope Hippotragus equinus, some impala Aepyceros

melampus (once common at Waza), vervet monkey Cercopithecus aethiops, patas monkey Erythrocebus patas, and olive baboon Papio anubis. Leopard Panthera pardus (T) and cheetah Acinonyx jubatus (T) are present but their current status is uncertain. Towards the end of the dry season, many animals move onto the Chari (Yaéré) plains. There is a diverse avifauna including ostrich Struthio camelus, ground hornbill Bucorvus abyssinicus, bateleur Terathopius ecaudatus, white-faced tree duck Dendrocygna arborea, Abyssinian roller Coracias abyssinica, standard-winged nightjar Macrodipteryx longipennis and guinea fowl Numida meleagris.

ZONING/CONSERVATION MANAGEMENT Two main zones can be visited from November to May according to the flood season and animal migrations. There is currently reported to be no management plan, though FAO/UNDP carried out a lot of work in Waza in the mid-1970s under a project to assist the Cameroon government in management and development of the parks of the savanna zone. This work is drawn by Vanpraet (1977) who makes a wide variety of comments and recommendations on park development and management. Control of poaching, bushfires and tree cutting is carried out by park wardens. Public education films have been shown in the park by Wildlife Clubs of Cameroon as part of IUCN/WWF Project 1317.

STAFF Twenty-five guard staff

LOCAL ADMINISTRATION Department of Wildlife and National Parks, General Delegation of Tourism. Secretariat Permanent, Comité National de l'Homme et de la Biosphère, BP 4742, Yaoundé.

VISITOR FACILITIES Visitor facilities are good. There is a hotel on the park boundary and park wardens accompany tourists in the park. There is no access on foot.

SCIENTIFIC RESEARCH AND FACILITIES Work by the Wildlife College at Garoua is supported by FAO/UNDP and the African Wildlife Foundation. Research has included ecological studies, population counts of several animal species and studies on elephant migration in the park. The park serves as a reference area for the MAB Cameroon Project on the integrated management of North Cameroon. Wildlife College at Garoua (about 350km away).

MODIFICATION OF THE NATURAL ENVIRONMENT Water continues to be one of the most serious problems for Waza. Since the drought of 1972/1973, when some 2,500 Buffon kob and eight giraffe died, rainfall has been low. Also the periodic inundation of the yaéré has been prevented by construction of the Maga Dam 25km south of the park (which blocks the Tsanaga, Guirleo and Logone Rivers) and by the digging of irrigation dykes along the Logone River. This effectively reduces the carrying capacity of the park as a whole, despite the provision and maintenance of waterholes. Poaching is reported to be extensive due mainly to the proximity of relatively unguarded borders with Nigeria and Chad. Regeneration of Sclerocarya vegetation in the scrub savannah area is poor due to burning and damage by elephants. Elephants also destroy some tree savannah. Some important dry season watering places and grazing lands are outside the park boundary and controlled by pastoral tribes. There are some villages in the park.

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IUCN/WWF Project 1613. Primate Action Fund.

Parc national de la Bénoué

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Total. Strict protection, though fishing is allowed on payment of a licence. No camping is allowed, and vehicles are not permitted to leave the roads.

DATE ESTABLISHED 5 November 1968 by Law No. 120/SEDR as a National Park. Originally established as a faunal reserve on 18 November 1932. Approved as a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION North Cameroon. Adjoining the Bénoué River and bordered on the west by the national highway between Ngaoundéré and Garoua, 175km south of Garoua, 150km north of Ngaoundéré. 7°55'-8°55'N, 13°34'-14°01'E.

ALTITUDE On average 300m, with mountain blocks reaching 800-1,100m

AREA 180,000ha, surrounded by controlled hunting zones.

LAND TENURE Government

PHYSICAL FEATURES On the Bénoué plain, at the foot of the Adomaoua plateau, though with a very rugged relief culminating in Mount Garoua (1,100m). The Bénoué river drains almost the entire park. After descending from the Adomaoua plateau the river winds its way northward through granitic bedrock for most of its length within the park, and then into an alluvial plain as it leaves the park after its confluence with the Laindelasl River. The north-west corner of the park is drained by the Sala River. Three-quarters of the park is underlain by a late pre-Cambrian base complex. Gneissose rock covers much of the area, but with grey and red Cretaceous sandstones in the north-west section. There are intrusions of porphyritic granite in the

north-central section, and basalt in the south. The soils are generally described as "ferruginous tropical". The climate is Sudanian, with a dry season from November to March with very low relative humidity and no precipitation. July through to September thunderstorms are very common, accompanied by heavy rain. Mean annual rainfall is around 800mm-1200mm and the mean annual temperature 24°C. December is coldest, with mean monthly minimum of 13°C and maximum of 32°C. April, just before the rains, is hottest with mean monthly minimum of 23°C and maximum of 36°C.

VEGETATION There are three main vegetation types: 1) Woody vegetation with closed canopy in areas with rocky soils; relatively dense basal cover and sparse underbrush with Isoberlinia doka predominating. 2) More open vegetation on less rocky soil, dense basal growth and moderate underbrush with the dominant tree being Burkea africana. 3) Light forest of mainly Anogeissus leiocarpus on sandy soils with relatively sparse basal cover and underbrush. Two other types are also recognised, Terminalia macroptera vegetation, usually on heavy soils, and Isoberlinia dalzjellii woodland vegetation. In fact most of the park is heavily wooded, and the predominant tree species are Isoberlina spp., Burkia africana, Afzelia africana, Terminalia spp., Anageissus leiocarpus and Borassus aethipum (an introduced palm). Other species recorded in the park include: Butyrospermum parkii (the oily seeds of which are pressed to yield shea butter), Daniellia oliveri, Monotes spp., Uapaca detarium, Vitex doniana, Lophira lanceolata, Combretum spp., Khaya senegalensis, Detarium microcarpum, Parkia biglobosa, Boswellia spp., Prosopis africana, Sterculia setigera, Cassia sieberana, Kigelia africana, and Ziziphus spp.. Baobab Adansonia digitata and kapok Ceiba pentandra trees characterize sites of past human habitation.

FAUNA The park contains most wild life associated with a sudano-guinean vegetation type. Mammals include elephant Loxodonta africana (T), lion Panthera leo, a few leopard P. pardus (T), probably caracal Felis caracal, hippopotamus Hippopotamus amphibius, black rhinoceros Diceros bicornis (T) (population of 15-20 in 1980), buffalo Syncerus caffer, hyena Crocuta crocuta (fairly rare in the park), warthog Phacochoerus aethiopicus, hartebeest Alcelaphus buselaphus, oribi Ourebia ourebi, bushbuck Tragelaphus scriptus, giant eland Taurotragus derbianus (T), red-flanked duiker Cephalophus rufilatus, common duiker Sylvicapra grimmia, roan antelope Hippotragus equinus, bohor reedbuck Redunca redunca, kob Kobus kob, waterbuck K. ellipsiprymnus and various monkey species such as olive baboon Papio anubis, black and white colobus Colobus guereza, patas monkey Erythrocebus patas, and Tantalus monkey Cercopithecus aethiops. There is a rich avifauna. The Nile crocodile Crocodylus niloticus (V) is also present, as is the Nile monitor Varanus niloticus and the pythons Python sebae and P. regius.

ZONING/CONSERVATION MANAGEMENT None. The park is surrounded by a hunting zone with five camps. One of the principal objectives of the area is its development for game viewing. There is a management plan which controls budget expenditure. Activities of the local population living near the boundaries are controlled. Ecological studies were undertaken in the park by UNDP/FAO with the aims of analysing wildlife conditions in the park (with special emphasis on buffalo), assessing the effects of fire on Afyclia africana, assessing road development within the park (in relation to both game viewing and their value as fire breaks), and to prepare a vegetation map and study fire policy within the park. Various developments and recommendations were discussed by FAO/UNDP relating to park extension, communications, tourist facilities, staffing, poaching and fire, and it was recommended that long-term, continuous research on the natural resources of the park was particularly important for future management (Stark and Wit, 1977). Public

education films have been shown in the park by the wildlife club of Cameroon as part of IUCN/WWF Project 1317.

STAFF One warden, four rangers, and eight guards

LOCAL ADMINISTRATION Department of Wildlife and National Parks, General Delegation of Tourism. Secretariat Permanent, Comité National de l'Homme et de la Biosphère, BP 4742, Yaoundé.

VISITOR FACILITIES Access to the park is relatively easy. Within the park there were in 1977 some 235km of graded roads, and this is likely to have increased since then. There are tourist lodges, and camps in the hunting zones surrounding the park.

SCIENTIFIC RESEARCH AND FACILITIES Studies by the Wildlife College at Garoua include a survey of the effects of burning, dry season mammal censusing, analysis of animal use of three vegetation types, and a bird species list. Species lists were also drawn up by UNDP/FAO, and are given in Stark and Wit (1975). Ecological research on various topics was also carried out under this project. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Poaching and bushfires are a major threat. The local population also collect firewood, and there is some cultivation. Fire appears to have cuased a reduction in Afzelia trees within the park.

PRINCIPAL REFERENCE MATERIAL

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Réserve forestière et de faune du Dja

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION Protected as a Game Reserve by Law No. 319 of 26 June 1950, and under the National Forestry Act Ordinance No. 73/18 of 22 May 1973. Agriculture and hunting are prohibited.

DATE ESTABLISHED 1950, as a forest and faunal reserve. Originally protected in 1932. Accepted as a Biosphere Reserve in October 1981. Proposed as a National Park.

GEOGRAPHICAL LOCATION On the Dja River in the South-central and East Provinces of Cameroon. 243km south-east of Yaoundé; 5km from Lomie. 2°49'-3°23'N, 12°25'-13°35'E.

ALTITUDE 400-800m

AREA 500,000ha

LAND TENURE Government

PHYSICAL FEATURES The reserve lies to the north of the Dja River, which becomes a tributary of the Congo. The relief is fairly flat, except in the south-east where tributaries of the Dja cut deep valleys. The Dja river on the southern boundary follows a major fault line. The soil is red clay, with crystalline rocks of Precambrian origin, composed of chlorite schist and micaschist. The mean annual temperature is 23°C and the mean annual rainfall is 1610mm. The Equatorial type climate has two rainfall peaks, in May and September. Temperatures are similar all year. August is coolest with mean monthly minimum of 18°C and maximum of 27°C. April is hottest with mean minimum temperature of 19°C and maximum of 30°C.

VEGETATION The vegetation comprises dense evergreen Congo rainforest of great height dominated by Sapotaceae with a main canopy of at least 43 tree species, predominantly legumes including Afrostyrax lepidophyllus, Anopyxis klaineana and Anthonotha. The shrub layer contains over 53 species including Diospyros spp. and Drypetes spp.. The grass layer is composed of Marantaceae and Mapania spp.. Other vegetation includes swamp vegetation, old secondary forest around the villages which were abandoned in 1946, recently abandoned cocoa and coffee plantations, and areas of Gilbertiodendron dewevrei forest.

FAUNA The area has a wide range of primate species including lowland gorilla Gorilla gorilla gorilla (T), greater white-nosed guenon Cercopithecus nictitans, moustached guenon C. cephus, crowned guenon C. pogonias, talapoin Miopithecus talapoin, white-collared mangabey Cercocebus torquatus, white-cheeked mangabey C. albigena, agile mangabey C. galeritus, mandrill Mandrillus sphinx, Angolan black and white colobus monkey Colobus angolensis and chimpanzee Pan troglodytes (T). Other mammals include: elephant Loxodonta africana (T), bongo Tragelaphus euryceros, sitatunga T. spekei, buffalo Syncerus caffer, leopard Panthera pardus (T), warthog Phacochoerus aethiopicus and pangolin Manis sp.. Bates's weaver Ploceus batesi (R), endemic to southern Cameroon, and grey-necked picathartes Picathartes oreas (R) probably occur in this reserve. The type locality of the Dja River warbler Bradypterus grandis (K) is near the reserve and there are few other records of this kind. Reptiles include python, lizard and crocodile.

ZONING/CONSERVATION MANAGEMENT There is no management plan. No commercial logging has taken place in the reserve. Traditional hunting rights are allowed but the use of non-traditional hunting methods needs to be controlled. Dja is the focus for IUCN/WWF Project 1613, whose ojectives are to conserve and develop three national parks in the forest zone (Dja, Pangar-Djerem and Korup) and to establish a programme of conservation education in the forest zone.

STAFF One conservator, one game guard, and eight rangers

LOCAL ADMINISTRATION Department of Water and Forests, Ministry of Agriculture, Yaoundé.

SCIENTIFIC RESEARCH AND FACILITIES Phytogeographic studies (Letouley, 1968) and a research report on fauna (Rowell, 1975) have been carried out. The area could serve as a reference zone for studies on tropical rainforest and is easily accessible by road (four-wheel drive) in the dry season.

LOCAL POPULATION There are some villages and a population of pygmies in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Cocoa, coffee and subsistence plots encroach onto the reserve. Poaching is a problem.

PRINCIPAL REFERENCE MATERIAL

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IUCN/WWF Project 1613. Primate Action Fund.

Mont St Hilaire

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern forest)

LEGAL PROTECTION Total

DATE ESTABLISHED The Gault Estate was established as a Federal Bird Sanctuary in 1952 by Order of Council and bequeathed to McGill University in 1958. In 1972 the Mont St Hilaire Nature Conservation Centre was established by legal agreement with the university for joint protection of the area. It was accepted in April 1978 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In Quebec province, just east of the Richelieu River, 50km above its junction with the St Lawrence and 32km east of Montreal; 45°33'N, 75°10'W.

ALTITUDE 106-416m

AREA Total 5,550ha; the Gault Estate covers 1,100ha

LAND TENURE The Gault Estate belongs to McGill University; the remainder is owned by the town of Mont St Hilaire, and the lake is under jurisdiction of the Regional Water Board.

PHYSICAL FEATURES Mont St Hilaire is the highest and most spectacular of the Monteregian Hills. These were formed by Cretaceous igneous intrusions into layers of softer Ordovician sediments which were subsequently eroded, leaving the harder igenous rocks and metamorphic rocks around them as a series of hills. There are various glacial features and evidence of post-Pleistocene marine submergence on the mountain, and a 36ha lake which is fed by three streams and encircled by eight peaks.

VEGETATION The mountain has one of the largest untouched areas of northern coniferous-hardwood forest in the eastern forest region; this once covered over 90% of western Quebec but has been reduced to 17% of the province's area. Deciduous trees dominate on the lower slopes, going higher on the north and east but at higher altitudes and more on south and west facing slopes they are interspersed with more conifers. The main tree species are sugar maple Acer saccharum, beech Fagus grandifolia, American lime Tilia americana, Weymouth pine Pinus strobus and eastern hemlock Tsuga canadensis. There are some areas of secondary forest, marshes and aquatic communities, and nearly 700 species of higher plants have been recorded on the mountain.

FAUNA Major aspects of the fauna of Mont St Hilaire have been studied and the following numbers recorded: 13 species of fish, 17 species of amphibians, 12 species of reptiles, 41 species of mammals and 178 species of birds, over 60% of the avifauna of south western Quebec, including 85 which nest on the mountain.

ZONING/CONSERVATION MANAGEMENT Zonation for visitor control has been introduced through the Master Plan by creating three areas, designated as the Research-Preservation Sector where human impact is least evident, the Nature Centre Sector with its controlled public area, and the Development/Access Sector which controls all access to other sectors. The Research-Preservation Sector acts as the core zone, with the two other areas as buffer zones. A master plan has lead to the creation of three areas for different uses and a long-term management plan has been approved. The whole reserve is covered by municipal bye-laws prohibiting camping, fires, snow-mobiles, loose dogs and

other disturbances. The Gault Estate is left undisturbed as much as possible. Man-made structures are only permitted in the Development/Access Sector.

STAFF Administration and management of the reserve are provided by the Gault Estate, whereas the Nature Centre runs a Public Information Programme. In addition, a number of researchers of the McGill University and other research institutions of Canada are carrying out research in the area.

LOCAL ADMINISTRATION 422 rue des Moulins, Mont St Hilaire, Quebec, JOL 1LO.

SCIENTIFIC RESEARCH AND FACILITIES Since 1958 the Gault Estate has been used by McGill University for a variety of studies in zoology, pedology, geology, meteorology and applied geophysics. Access to the core area is allowed by permit. There are two quarries in the buffer zone which are being closed which will become available for studying mineralogy and rehabilitation schemes. Gault House is a conference centre with laboratories, doromitories, staff accommodation. It also houses the Institute for Mineral Industry Research.

LOCAL POPULATION The surrounding area is agricultural with several towns nearby, but there is a high level of conservation awareness due to the strong emphasis on nature education.

MODIFICATION OF THE NATURAL ENVIRONMENT The strict zoning and emphasis on education rather than recreation means that human impact is limited, but even so, the high number of visitors means that numbers and activities have to be restricted. Scientific work which often ranges through the forest, including the core zone, has to be regulated to minimise disturbance of fragile areas. In the past, some areas were farmed and suffered from fires, so the forest was a secondary character in a few places.

PRINCIPAL REFERENCE MATERIAL

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Waterton Lakes National Park

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION Total

DATE ESTABLISHED Waterton or Kootenay Lakes Forest Park was established in 1895 and, after the 1906 Dominion Forest Reserves Act, made into the Kootenay Lakes Forest Reserve. In 1911 the Waterton Lakes Dominion Park, with a smaller area, was created within an enlarged Rocky Mountain Forest Reserve. However, its size was enlarged within three years, and since then the

boundaries have been slightly varied from time to time. It was combined with Glacier National Park in Montana in 1932 to form the first International Peace Park in the world and accepted in May 1979 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Situated in the extreme south-west of Alberta Province, along the eastern slopes of the Continental Divide and at the western margin of the Canadian Great Plains region. Bounded to the south by Glacier National Park, Montana, to the west by British Columbia and to the north and east by the Crowsnest Forest Reserve, the County of Pincher Creek and the County of Cardston, 49°00'-49°12'N, 113°39'-114°10'W.

ALTITUDE 1,274-2,918m

AREA 52,597ha

LAND TENURE Government of Canada

PHYSICAL FEATURES The park is noted for its scenery, being located along the eastern margin of the Rocky Mountains, in the Clark and Border ranges. The bedrock comprises Precambrian sedimentary formations overlying much younger Cretaceous sediments resulting from a major thrust fault, the Lewis Overthrust. The Precambrian formations contain some of the oldest rocks exposed in the Rocky Mountains. The most obvious feature of the park is the sudden transition from prairie to mountain landscape, emphasized by the virtual absence of intervening foothills. The mountain valleys and rock basins were shaped by glacial erosion, while the rolling grasslands are a result of glacial deposition. The park lies just to the north of the Hudson's Bay-Missouri drainage divide, and the major streams, the Belly and Waterton rivers, north-east into the Saskatchewan drainage system. The Waterton River drains a series of large lakes, around which the park is centred. The climate is continental and maritime, a consequence of the park's location on a Pacific storm track. Mean annual precipitation is about 920mm. Mean monthly temperatures are -9.4°C in January and 17.2°C in July.

VEGETATION The park is species rich, being situated at the junction of cordilleran and prairie ecosystems. The vegetation comprises a limited area of grassland, extensive areas of broadleaf and coniferous forest, alpine tundra and narrow transition zones. Twenty-three different habitat types have been recognized in the park, with some 870 species of vascular plants, 182 bryophytes and 218 lichens, many at the edge of their geographic ranges. The small grassland area is of special significance as it is one of the few good examples of prairie grassland protected in the Canadian national parks system. In addition, differences exist between the biota of the northern and southern portions of the Rocky Mountains, with Waterton being situated at the transition. Due to the maritime climate, many species closely related to the flora of the far west (Idaho and Washington) are also found in the park. The prairie grasslands are dominated by a Festuca-Danthonia association; the mountain zone by Douglas fir Pseudotsuga menziesii, lodgepole pine Pinus contorta, limber pine P. flexilis, whitebark pine P. albicaulis, white spruce Picea glauca, Engelmann spruce P. engelmannii and alpine fir Abies lasiocarpa. In or near the transitional zone, species such as aspen Populus tremuloides, cottonwood P. sargentii, canoe or paper birch Betula papyrifera, Douglas maple Acer glabrum, Sitka alder Alnus sinuata and willows Salix spp. are found. Arctic-alpine communities above the tree line include Dryas octopetala and Polemonium viscosum as dominants, with a large area occupied by lichens, principally Rhizocarpon geographicum and Lecidea spp. Noteworthy species found in the park are Taxus brevifolia, Potentilla villosa and Townsendia condensata.

FAUNA The park is noted for the abundance of wildlife and due to wide diversity of habitats. Investigations carried out since 1938 have listed 61 species of mammals, 241 species of birds, and 20 species of fish; reptiles and amphibians have not been extensively studied. The prairie grasslands and shrublands supports a great diversity of mammalian species. Carnivores include wolf Canis lupus (V), coyote C. latrans, cougar Felis concolor, grizzly bear Ursus arctos horribilis, American black bear U. americanus and mink Mustela vison. The grasslands are important winter range for ungulates, and the seasonal migrations of large ungulates is one of the park's most outstanding wildlife spectacles. The most notable of these migrations is that of the elk Cervus canadensis nelsoni herd from eastern Glacier National Park, Montana, which crosses into Waterton and winters on the grasslands. Other ungulates include mule deer Odocoileus hemionus, white-tailed deer O. virginianus, moose Alces alces, bison Bison bison, Rocky Mountain goat Oreamnos americanus and bighorn sheep Ovis canadensis. Rodents include beaver Castor canadensis and muskrat Ondatra zibethica. It is also notable that, due to the distinct ecological setting of the park, a number of southern subspecies of certain mammals make their appearance only in this area of Alberta. Waterton is located on the margin of two major avian migratory routes; the Central and Pacific flyways overlap here, and the marsh and lake areas of the park are used extensively as staging areas. The fish fauna includes pike Esox lucius, lake whitefish Coregonus clupeaformis, Rocky Mountain whitefish Prosopium williamsoni, cut-throat trout Salmo clarki, rainbow trout S. gairdnerii, Dolly Varden trout Salvelinus malma, lake trout Cristivomer namaycush, eastern brook trout S. fontinalis and Arctic grayling Thymallus signifer.

CULTURAL HERITAGE Waterton Park has been identified as one of the most significant areas for archaeological study in the province. Over 200 sites have been identified, many of which are of unknown significance and remain to be studied.

ZONING/CONSERVATION MANAGEMENT This follows the National Parks Zoning System. Special Preservation areas with highest protection limited to a few small areas of archaeological significance. Wilderness areas and natural environment areas cover 48.2% and 43.6% respectively while recreation and park services zones take up only about 5% of the park. Outside the park, two protected areas act as further buffers: Glacier National Park to the south (405,089ha) and Crowsnest Forest Reserve to the east. A management plan was published in 1978 and the park is zoned to accommodate different land uses. Former land uses, like logging and grazing, are not permitted.

STAFF There are 44 full-time employees and an allocation of 77 man years

LOCAL ADMINISTRATION Superintendent, Waterton Lake National Park, Waterton Park, Alberta, TOK 2MO.

VISITOR FACILITIES Nearly 200km of trails exist and a variety of sports facilities, including boating, riding, cycle hire, golf and fishing. There are numerous campsites and group tenting areas. The tourist township, in the park of Waterton provides nearly all the facilities of a modern town, including a motel lodge and bungalows. Access is provided by two provincial highways and one interstate highway. 644,035 visitors were recorded in 1981-82.

SCIENTIFIC RESEARCH AND FACILITIES Many noted biologists and naturalists have visited the Waterton Lakes National Park area, the earliest of these being Captain Thomas Blakiston (Palliser Expedition 1857-59) and Elbot Coves

(1874). In the years 1895 and 1922-23, collections were made and field work carried out by the National Museum of Canada. Scientific investigation increased rapidly after 1938, with emphasis on specialized studies in limnology, wildlife management, ecology, pedology and archaeology, mostly carried out under contract by agencies such as the Canadian Wildlife Service. These projects were largely management oriented and designed to cause as little interference to the park as possible. Considerable potential exists in the area for studies in the field of archaeology. No research facilities exist at the park. A small reference library is maintained in the park administration building by the Interpretative Service.

MODIFICATION OF THE NATURAL ENVIRONMENT This is a heavily used seasonal resort with a well developed township providing visitor facilities. Two provincial and one interstate highway provide access, one of which bisects the eastern end of the park. Powered boats are permitted on designated lakes. The number of campgrounds has been reduced from 13 to four, which has now helped to minimise the impact of the large numbers of visitors. Grazing of livestock, limited logging, and some commercial fishing were allowed in the park's early years, but these practices have now been discontinued. The park is too small to be a self-contained ecological unit. Park boundaries cut across wildlife ranges and there is some conflict with neighbouring ranches where hunting is permitted, when migratory ungulates move between their traditional grazing lands.

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Long Point Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.22.14 (Great Lakes)

LEGAL PROTECTION Total

DATE ESTABLISHED Most of the land was bought, and subsequently managed, in 1866 by the Long Point Company. The area east of Big Creek Marsh and west of the Old Cut was established on 3 May 1921 in the Long Point Park Act; several

small lots were added up to 1944 to total 930ha. From 1959 to 1961 nearly all this area was sold to cottagers. In 1961 an area of 325ha to the east of the old park boundary was expropriated and forms the present Long Point Provincial Park. From 1961 the Ministry of Natural Resources operated a Waterfowl Management Unit of 700ha. In 1956, 36ha near the tip were transferred to the Province of Ontario. In 1978 and 1979, 3,240ha at the eastern end were transferred to the Canadian Wildlife Authority, including about half of the Long Point Company's holdings. 13,730ha were accepted as a Ramsar site in May 1982 and the whole area was accepted as a Biosphere Reserve in April 1986.

GEOGRAPHICAL LOCATION On the northern shore of Lake Erie in the regional municipality of Haldimand-Norfolk, about 100km south-west of Hamilton; 43°35'N, 80°20'W.

ALTITUDE 175-188m

AREA 27,000ha

LAND TENURE Most owned by the Canadian Government; Long Point Provincial Park and Crown Marsh by the provincial government; Ryersons Island and 3,200ha of adjacent marsh by the Long Point Company; the Anderson property by the Nature Conservancy and private individuals; land near the tip by the Ontario Ministry of Natural Resources (820ha) and Transport Canada (30ha).

PHYSICAL FEATURES Long Point is the largest and finest area of sand spit and dune formation in the Great Lakes, being 32km long. The biosphere reserve includes the surrounding fresh waters of Lake Erie to a depth of ten metres. It is one of three sand spits in this lake which formed near the point where a cross-lake moraine intersects the shoreline, and has an approximately east-west orientation with marshes, pools and creeks on the northern side. Its shape is continually changing due to the action of water and the prevailing south-west winds, which also moderate the continental climate. The soils are sandy and vulnerable to erosion, and even on older ridges the organic layer is thin. Between some ridges, where drainage is imperfect, organic soils have developed more fully. The mean annual temperature is 7.9°C with a mean summer temperature of 22°C and 1°C in winter. Mean annual precipitation is 998mm, and there are 200 frost free days.

VEGETATION The southern location of Long Point and climatic moderation by Lake Erie allow many plants to exist at the northern limits of their distribution. Different stages of plant succession are represented by eleven distinct associations, from open beach to red oak Quercus borealis and sugar maple Acer saccharum forest. About 700 species of vascular plants have been recorded of which 90 are rare in Ontario and four are found nowhere else in Canada.

FAUNA Long Point is particularly significant for birds, with Inner Bay providing a feeding area for 30 regular species on autumn and spring migration. About 300 bird species have been recorded and about 100 breed here. Up to 30,000 whistling swan Cygnus columbianus pass through on migration and Long Point is the most important stop over for redhead Aythya americana (100,000 or 11% of the total population) and canvasback A. valisineria (43,000 or 14% of the total population). Over 10,000 gulls Larus spp. spend the summer on the beaches. Rare breeding birds include prothonotary warbler Protonotaria citrea and bald eagle Haliaeetus leucocephalus. Many of Canada's reptile and amphibian species can be found here, including large numbers of turtles. The marshes are important spawning areas for many of Lake Erie's fish. Invertebrates have not been extensively

studied but include large numbers of migrating monarch butterflies Danaus plexippus in autumn. Ontario's rarest crayfish, the meadow crayfish Cambarus diogenes occurs here.

CULTURAL HERITAGE Archaeological evidence has shown that the shores of Inner Bay were settled by Iroquois between 700 and 1650 A.D. as remains of fishing camps have been found. More recently there has been land clearance and deforestation. The ownership of a large area of the spit by the Long Point Company since 1866, who kept it as an exclusive reserve for hunting waterfowl, has led to the preservation of many natural features. There are several wrecks along the shores which are exposed from time to time.

ZONING/CONSERVATION MANAGEMENT On the mainland, the buffer zone extends to the 100-year flood line, while in Lake Erie it extends to the ten metre depth contour, the average depth of the summer thermocline. There is a core zone of 6,250ha. Most intensive use and tourist development is restricted to Long Point and Turkey Point Provincial Parks, and Long Point Crown Marsh to the west of the former. The National Wildlife Area is a zone of limited public access to the east of Long Point Provincial Park. A detailed management plan has been published (McKeating, 1983) and a second report has examined impacts on the ecosystem in more detail (Francis, 1985). Private land owners have agreed to the management plan. The area administered by the Canadian Wildlife Service is managed as a wilderness area. Rehabilitation will be undertaken in certain areas, including removal of exotics, reintroduction of native species and possible control of white-tailed deer Odocoileus virginianus which prevent tree regeneration. Muskrat Ondatra zibethicus may be harvested under licence and wildfowling, sport fishing, canoeing and wildlife viewing are permitted in some areas. Environmentally sensitive areas will be specially protected and access to certain areas is restricted in bird breeding seasons. Plans include increasing public awareness of the area's importance through information leaflets, marked walks and an interpretive centre. Tourism is concentrated in the Provincial Parks and development of any kind is restricted in the buffer zone.

STAFF There are 11 permanent staff, including six graduates. There are also seasonal employees.

LOCAL ADMINISTRATION Canadian Wildlife Service, 152 Newbold Court, London, Ontario, N6E 1Z7.

VISITOR FACILITIES Camping is allowed in the Provincial Parks and sport fishing, walking, canoeing, waterfowl viewing or hunting, boating and swimming allowed in certain areas. Overnight mooring is not allowed in much of the water area. There is easy access by road or small boat.

SCIENTIFIC RESEARCH AND FACILITIES Much research has been carried out in connection with wildlife management, recreation and fisheries and the effects of the Haldimand industrial development. Since 1960 the Long Point Bird Observatory has been recording and ringing birds, a total of 211,359 up till the end of 1981. Waterfowl are censused annually. Field stations exist and accommodation is available at a variety of localities.

LOCAL POPULATION There are no residents in the core area except a lighthouse keeper, a caretaker and seasonal residents, involved in intensive agriculture. The Nanticoke industrial complex includes a coal-fired power station, steel plant and oil refinery and is only 30km away across Long Point Bay.

MODIFICATION OF THE NATURAL ENVIRONMENT Much of the character of the systems on Long Point depend on external influences; sediments are continually being transported from further along the shore of Lake Erie and the general quality of the lake's water affects the Point. Air pollution from nearby industry is a concern. Marina development and the cutting of private channels are a constant threat. Increased uses of chemicals on the mainland farms could affect water quality. Eight fires during the last century have changed much of the core area from forest to more open savanna.

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Riding Mountain Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.04.03 and 1.18.11 (Canadian Taiga and Grasslands)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1895 an area of 247,000ha was set aside as a Forest Reseve and within it, in 1906, a game reserve was set up. The National Park was established in 1930 and the area accepted as a Biosphere Reserve in April 1986

GEOGRAPHICAL LOCATION South central Canada, on the Manitoba escarpment, 300km north-west of Winnipeg, 50°30'-51°01'N, 99°31'-101°05'W.

ALTITUDE 318-755m

AREA The Biosphere Reserve covers an area of 297,591ha

LAND TENURE Government of Canada

PHYSICAL FEATURES The park is situated in the Manitoba Escarpment region. This 300-350m high escarpment was part of the shoreline of the glacial Lake Agassiz and separates the Manitoba and Saskatchewan plains. Much of the park is a rolling plateau where the bedrock is covered with thick glacial deposits of sand, clay, gravel and boulders. Glacial features include kettle holes, meltwater channels, morainal ridges and incised gorges and there are many shallow lakes. The headwaters of 13 watersheds are contained in the park. The climate is cool summer humid continental, with mean January temperatures of -2°C and July temperatures of 16°C. Annual precipitation is about 480mm.

VEGETATION The reserve is at the junction of three major ecosystems, grasslands and two components of the boreal forest biome, the aspen-oak and aspen-spruce ecosystems. Forests cover about 78% of the park and about two-thirds of their area is dominated by aspen Populus tremuloides, either in pure or mixed stands, reflecting earlier distrubance by logging and fires.

Other trees in the coniferous ecosystem include white spruce Picea glauca, black spruce P. mariana, jack pine Pinus banksiana and balsam fir Abies balsamea. The aspen-oak ecosystem includes bur oak Quercus macrocarpa, Manitoba maple Acer negundo, mountain maple A. spicatum, green ash Fraxinus pennsylvanica, plum Prunus nigra, chokecherry P. virginiana and white elm Ulmus americana. Grasslands are dominated by rough fescue Festuca scabrella with porcupine grass Stipa spartea and dwarf sedges Carex spp.. Although grasslands occupy less than 1% of the reserve, they exist as discrete units and the climax rough fescue community represents the eastern extent of its range and its presence is of national importance due to the relative rarity of climax examples elsewhere. Over 400 species of vascular plant have been recorded in the park, 17 being rare in Manitoba.

FAUNA The reserve is a near complete natural food web and is a refuge, surrounded by agricultural land. The beaver Castor canadensis, is abundant, and some interesting small rodents such as the water shrew Sorex palustris, vagrant shrew S. vagrans and northern lemming mouse Synaptamus borealis. There are several carnivores, including the wolf Canis lupus, coyote C. latrans, black bear Ursus americanus and Canadian lynx Lynx lynx canadensis, and ungulates such as moose Alces alces, bison Bison bison, mule deer Odocoileus hemionus and white-tailed deer O. virginianus. Two hundred and thirty-three species of birds have been recorded, among them the bald eagle Haliaeetus leucocephalus and osprey Pandion haliaetus which both nest in the park. The fish species found in the park include pike Esox lucius, lake whitefish Coregonus clupeaformis, walleye Strizostedion vitreum vitreum, lake trout Cristivomer namaycush, rainbow trout Salmo gairdnerii and speckled trout Salvelinus fontinalis. The area is internationally known for its diversity of Lepidoptera, with 69 species of butterflies including 13 skippers recorded.

CULTURAL HERITAGE Artefacts up to 4,000 years old have been found and indicate that native peoples visited the park to hunt and fish. Some fur traders exploited the area in the 18th century.

ZONING/CONSERVATION MANAGEMENT This is in accordance with the National Parks Zoning System. Twelve core areas, or Special Preservation Zones, have been designated. Most of the reserve is a Wilderness Area. One site is set aside for Intensive Use and some sites have been set aside for roads and campsites. The surrounding Rural Municipalities are designated a Zone of Cooperation to act as an additional buffer. The area has been zoned to accommodate different land uses, and managed accordingly. Since 1980, additional baseline data has been collected and management objectives made more explicit. In 1980 the Riding Mountain Regional Liaison Committee was formed which includes representatives from the surrounding 18 municipalities.

STAFF There are 105 full-time employees

LOCAL ADMINISTRATION Superintendent, Riding Mountain National Park, Wasagaming, Manitoba ROJ 2HO.

VISITOR FACILITIES There ar 657 campsites, 240 group tenting sites 158, trailer sites and some cottages; services and supplies or alternative accommodation are available in the town of Wasagaming. Power boating on some lakes and fishing are permitted and skiing is being developed. There are 32 trails which can be used on foot, cycle or horseback. In 1981-82 there were 842,436 visitors. There is an interpretive centre and a variety of educational programmes are available.

SCIENTIFIC RESEARCH AND FACILITIES There have been studies of the ecology of elk, moose, wolf, coyote, beaver and snowshoe hare and grassland ecology. Wilson Creek Watershed is a major long term research program and investigates possible remedies for headwater flooding. There is no special facilities, apart from a meteorological station.

LOCAL POPULATION The surrounding area has a largely rural population but agricultural development is intensive.

MODIFICATION OF THE NATURAL ENVIRONMENT A public highway traverses the eastern end of the park and the seasonal resort facilities are highly urbanized; power boats are permitted on certain lakes and skiing facilities have been developed. There are some cottage developments inside the park. Sport fishing is permitted. The vegetation has been altered by past grazing and logging, now discontinued. Intensive agricultural development of surrounding lands causes pressure on the wildlife populations of the park.

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Basse-Lobaye Forest

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION No restriction on human activities

DATE ESTABLISHED Accepted as a Biosphere Reserve in October 1977 by Unesco. No decree under national law, but known as a schedueled forest.

GEOGRAPHICAL LOCATION In the south-west of the country on the border with Congo-Brazzaville. 3°40'N, 17°50'E.

ALTITUDE Less than 500m

AREA 18,200ha

LAND TENURE Government

PHYSICAL FEATURES The climate of the region is hot and wet with little annual variation. Mean annual temperature is 24.5°C and the relative humidity is 93% at six in the morning and 78% at noon. There is a short dry season in January and a rainy season from March to December with high rainfall in August, September, and October (230mm/month). Mean annual rainfall is 1761mm.

VEGETATION The vegetation comprises dense, humid, semi-deciduous forest of Ulmaceae, Sterculiaceae, Meliaceae, and Sapotaceae which has not been exploited for at least the last 40 to 50 years. The canopy at about 40m is discontinuous, the intermediate storeys well developed, and the undergrowth thin. In the northern area, there is secondary growth on fallow cultivation, with more open canopy, less variation of intermediate storeys and a dense, shrubby undergrowth characterized by creepers.

FAUNA Common mammals include various species of duiker Cephalophus and monkeys Cercopithecus, Colobus, and Cercocebus. Chimpanzee Pan troglodytes (T) and forest elephant Loxodonta africana cyclotis (T) are rare. Carnivores include leopard Panthera pardus (T), African civet Civettictis civetta, potto Perodicticus potto, and genet Genetta spp.. Snakes include puff adder Bitis arietans, mamba, spitting cobra Naja nigricollis and python. The relatively few bird species include: hornbill, grey parrot Psittacus erithacus, giant kingfisher Ceryle maxima, and Hartlaub's goose Pteronetta hartlaubii.

ZONING/CONSERVATION MANAGEMENT There is no management plan

STAFF Three permanent employees

LOCAL ADMINISTRATION Ministère des Eaux et Forêts, BP 830, Bangui.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES A study of man in the tropical rainforest ecosystem was started by the 'Centre Eurafricain de Biologies Humaines' among the Aka pygmy communities in 1974. Specialists from CEABH, CNTS, ORSTOM, the Pasteur Institute, the 'Centre d'Hémitypologie' of CNRS and Paris universities have taken part in this study which has become a MAB project. A laboratory has been established at the research centre at Bokaka.

LOCAL POPULATION The area is inhabited by the Aka pygmies who live by hunting and gathering. The reserve also includes the zone on the fringe of the forest which contains several local villages.

MODIFICATION OF THE NATURAL ENVIRONMENT Disturbance is serious in the northern part near villages but there is none in the area of the pygmies.

PRINCIPAL REFERENCE MATERIAL Publications on region and population have been produced by the Pasteur Institute, the 'Centre Eurafricain de Biologie Humaine' and ORSTOM.

Bamingui-Bangoran Conservation Area

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION All areas were redefined in 1940 to comply with the London Convention on the Protection of African Wildlife, 1933.

DATE ESTABLISHED Established as Oubangui-Chari National Park (2,660,000ha) in 1933. Later in the same year 630,000ha were declassified, part of which now forms the Koukourou-Bamingui Faunal Reserve (110,000ha). A further 530,000ha were declassified in 1934, part of which now forms the Gribingui-Bamingui Faunal Reserve. Both faunal reserves were designated in 1940. The strict nature reserve was also established by reclassification of part of the park (the area was then defined as 150,000ha). A further area was added to the north of the park in 1980 and then revised the same year to form the Avakaba Presidential Park (established in 1980 by Ordinance No.80/055). The current conservation area was accepted as Bamingui-Bangoran Conservation Area (Biosphere Reserve) on 23 July 1979, but this has never been promulgated in national law.

GEOGRAPHICAL LOCATION Situated in the north of the country on the international border with Chad. 7°06'-8°04'N, 18°56'-20°21'E.

ALTITUDE 350-450m

AREA Vassoko-Bolo Strict Nature Reserve (86,000ha), Bamingui-Bangoran National Park (1,070,000ha), Koukourou-Bamingui Faunal Reserve (110,000ha), Gribingui-Bamingui Faunal Reserve (438,000ha) and Bamingui-Bangoran Conservation Area (Biosphere Reserve) 1,622,000ha.

LAND TENURE Government

PHYSICAL FEATURES The reserves lie in an area of low relief, mainly of Precambrian basement complex which dips below the Quaternary alluvia of the Chad basin in the north and north-west. There are three principal rivers, the Bolo (seasonal), Vassako and Vou (seasonal), which define the boundaries of the strict nature reserve. Several parts of the area are seasonally flooded. The mean annual rainfall is 1300mm, falling mainly between December and February. The mean annual temperature is 26.6°C.

VEGETATION Sudano-Guinean vegetation predominates, with dry forests, wooded savannas, edpahic savannas, and gallery forests. The wooded savanna comprises Terminalia (34%), Anogeissus (8%), Isoberlinia doka (38%), and grassland (13%).

FAUNA The fauna is also typically Sudano-Guinean and has been very rich in the past. The area is sufficiently large to include a large range of migratory mammals. Mammals include: leopard Panthera pardus (T), hunting dog

Lycaon pictus (T), spotted hyena Crocuta crocuta, elephant Loxodonta africana (T), hippopotamus Hippopotamus amphibius, black rhinoceros Diceros bicornis (T), buffalo Syncerus caffer, giraffe Giraffa camelopardalis, bushbuck Tragelaphus scriptus, giant eland Taurotragus derbianus, roan antelope Hippotragus equinus, waterbuck Kobus ellipsiprymnus, kob K. kob, reedbuck Redunca redunca, hartebeest Alcelaphus buselaphus, topi Damaliscus lunatus, yellow-backed duiker Cephalophus sylvicultor, red-flanked duiker C. rufilatus, blue duiker C. monticola, common duiker Sylvicapra grimmia, oribi Ourebia ourebi, warthog Phacochoerus aethiopicus, olive baboon Papio anubis, patas monkey Erythrocebus patas, vervet monkey Cercopithecus aethiops, eastern black-and-white colobus Colobus guereza, giant ground pangolin Manis gigantea, central African hare Poelagus marjorita, white-tailed mongoose Ichneumia albicauda, banded mongoose Mungos mungo, serval Felis serval, genet Genetta sp., African civet Civettictis civetta, aardvark Orycteropus afer, porcupine Hystrix cristata, cane rat Thryonomys sp., savanna gerbil Tatera valida, multimammate rat Praomys natalensis fumatus, striped grass rat Lemniscomys striatus, and Geoffroy's ground squirrel Xerus erythropus. The bird fauna is described in Green (1983 and 1984).

ZONING/CONSERVATION MANAGEMENT The four areas in the complex are defined differently in law. Together they comprise a central (or core) area, buffer zone, manipulative zone, and zone of traditional cultivation. No substantial new changes will be permitted in the cultivated zone. The strict nature reserve is entirely enclosed by the national park.

STAFF Three proposed

LOCAL ADMINISTRATION CNPAF, Ministère de l'Agriculture, Direction Générale des Eaux et Forêts, BP 830, Bangui. The national park comes under the Ndélé Forestry Inspectorate.

VISITOR FACILITIES The potential for tourism is limited, with visibility reduced by vegetation, and relatively few animals to observe. The Bangoran River is considered of most interest.

SCIENTIFIC RESEARCH AND FACILITIES Preliminary studies, including an air-count of the larger mammals, have been carried out in the area by UNDP/FAO consultants. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Because of persistent application of insecticide against cotton pests, the Bamingui River and tributaries are rapidly being poisoned and are becoming sterile. Poaching continues to be a major problem, particularly in the faunal reserves, where there is insufficient access for proper control and wildlife numbers have been seriously depleted. There are some areas of traditional and cotton cultivation.

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Parque Nacional Fray Jorge
(Including Reserva Nacional Las Chinchillas)

BIOGEOGRAPHICAL PROVINCE 8.23.06/8.37.12 (Chilean Sclerophyll/Southern Andean)

LEGAL PROTECTION Total

DATE ESTABLISHED Fray Jorge was declared a National Park for Tourism under Decree No. 728 of 29 March 1941 of the Ministry of Lands and Settlement. Modifications were made by Decrees 318 and 326 of 1 June 1967. It was accepted as a Biosphere Reserve in June 1977. Las Chinchillas was established as a reserve under Supreme Decree No. 153, 30 November 1983 and added to the Biosphere Reserve.

GEOGRAPHICAL LOCATION The Fray Jorge National Park comprises the Fray Jorge, Talinay and Punta del Viento National Parks, situated in the IVth Region, the province of Limari, and the municipality of Ovalle; 450km north of Santiago and 110km south of La Serena. The park extends along the range of mountains forming the Cordillera de la Costa; 30°34'S, 71°11'W. Las Chinchillas is located approximately 200km away, 15km northeast of the village of Auco. It is situated in mountainous terrain shaped by tributaries of the river Auco. 71°06'W-31°30'S.

ALTITUDE 0-762m in Fray Jorge, 375-1,427m in Las Chinchillas

AREA 14,074ha, Fray Jorge covers 9,959ha and Las Chinchillas 4,229ha.

LAND TENURE State property. Las Chinchillas was private property until 1983 when it was acquired by the State.

PHYSICAL FEATURES The park is situated in the mountainous Andean coastal complex which extends between the River Elqui in the north to the Aconcagua in the south. There are two kinds of topography: coastal plains and mountainous hinterland. The coastal plains have terraces of marine and pluvio-marine origin. There are no permanent rivers or creeks in the park, but a few springs exist. Las Chinchillas is characterised by its broken topography with low hills cut by narrow streams. The soil is sand or near-sand, completely deficient in nitrogen with rocks and cretaceous sedimentation. Mean annual temperature is 15.5°C and rainfall 215mm at 375m above sea level. In Fray Jorge, the climate is of a modified desert type. The average monthly temperature is 14.4°C with a maximum of 18.6°C. South-westerly winds prevail except in the winter, when the wind blows from the north. As the moist sea breezes blow up over the coastal range, an almost continual cloud cover is formed over the peaks, accompanied by increased precipitation.

VEGETATION The park is situated in the area bordering the scrub formations and semi-desert coastal steppes on the one side, and the tree and shrub formations of the Cordillera de la Costa in the Central Region, on the other. The most important feature of this National Park is the presence of the most northerly forest in Chile. The Fray Jorge forests are green "oases" surrounded by semi-arid lands; they have some features in common with the hygrophilous forests of the south (Valdiviano forest). The vegetation of the park (east to west) includes: a zone of semi-desert shrub formations with herbaceous species such as broom Gutierrezia paniculata, furze Chuquiraga ulicina, and shrubs such as the incense tree Flourensis thurifera, the puscana Proustia pungens, the palo negro Cassia stipulacea and guaiacum Porlieria chilensis; a zone with northern exposure containing Cactaceae, intermingled

with varilla Adesmia angustifolia and palo negro; an inner-valley zone with a shrub association of varilla and broom; a wooded zone dominated by copses of olivillo Aextoxicon punctatum and arrayan macho Rhaphithamnus spinosa, and separated by areas of shrub and pasture vegetation such as romerollo Lythrum hyssopifolia, pasto salado Distichlis spicata, cuerno de cabra Haplopappus foliusus, berberry Berberis spp., bollén Kageneckia oblonga and palo blanco Fuchsia lycioides; and a coastal zone of varilla, puscana and cardén Puya chilensis.

FAUNA The park shelters almost all the Mediterranean species typical of Chile. Among the great variety of birds are partridge Nothoprocta perdicaria, dove Zenaida auriculata, meadow lark Sturnella loyca, thrush Turdus falklandii, goldfinch Diuca diuca, mockingbird Mimus thenca, thrush Curaeus curaeus, and the pigeon Columba araucana. There is little variety in the mammals, the most noteworthy being the fox Dusicyon culpaeus, the quique Galictis cuja and the chingue Conepatus chinga. Large numbers of rodents are found, but there are few Batrachia or other amphibia. Introduced exotic fauna of importance include the quail Lophortyx californica and the hare Lepus europaeus. The guanaco Lama guanicoe has become extinct in this region. The only known population of the chinchilla Chinchilla lanigera occurs in the area of Las Chinchillas, as well as degus Octodon degus, puma Felis concolor and pampas cat F. colocolo. Notable avifauna include tinamou Northoprocta perdicaria, Andean condor Vultur gryphus, harrier Circus cinereus, burrowing owl Speotyto cunicularia and meadowlark Sturnella loyca.

ZONING/CONSERVATION MANAGEMENT None at present, but consideration is being given to the following management zones: inaccessible zone, primitive zone, zone for intensive use, zone for extensive use, zone for special use. A management plan was published in 1974 which sets out the objectives of the Fray Jorge National Park. It is unknown what conservation management techniques are currently employed.

STAFF An administrator, a ranger and eight workmen

LOCAL ADMINISTRATION Guido Soto, Corporacion Nacional Forestal, IV-Region, Lincoyan 300, Los Vilos.

VISITOR FACILITIES The management plan detailed plans of the development of camping and picnic areas, hostelries, an education centre and tourist information. It is unknown whether these plans have been carried out.

SCIENTIFIC RESEARCH AND FACILITIES Priority will be given to research projects relating to management programmes for the park. Research priorities include study of the micro-climate, the vegetation, the fauna and the ecology in general; evolutionary study of the forest and its degradation; feasibility study of reintroducing species which previously existed in the region, such as the guanaco Lama guanicoe and the chinchilla Chinchilla lanigera; study of plant succession; study of the natural regeneration of the desert area. No facilities in Fray Jorge Park, however there is good access into Las Chinchillas and adequate housing for five scientists although there are no laboratories.

MODIFICATION OF THE NATURAL ENVIRONMENT The park has remained in its natural state. There is no evidence of farming, intensive stock-raising or exploitation of the forest though there has been some introduction of livestock from adjacent land. However, in Las Chinchillas there has been

excessive grazing, felling of trees and coal mining. Although the area is now protected, it is still eroded, grazing continues and there are national motor-routes and railways running through the territory.

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Parque Nacional Juan Fernandez

BIOGEOGRAPHICAL PROVINCE 5.04.13 (Southeastern Polynesian)

LEGAL PROTECTION Total. Administered by the Chilean Forestry Service (CONAF). General prohibition on the exploitation of flora and fauna, especially the felling of chonta palms Juania australis and tree ferns on Robinson Crusoe Island. Decree 1310, 18 August 1954, limits livestock raising and prohibits exploitation of forests; Decree 619, 15 September 1954, prohibits hunting. In 1976 the management plan for the national park was published.

DATE ESTABLISHED National Park established 16 January 1935 by Decree 103. Accepted as Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION 650km from the Chilean coast in the Pacific Ocean. 33°41'S, 78°47'-80°47'W. The reserve includes the whole of the Archipelago consisting of Robinson Crusoe, Alexander Selkirk and Santa Clara islands and all the islets in the area, with the exception of about 44ha occupied by the town of San Juan Bautista, Robinson Crusoe Island.

ALTITUDE Robinson Crusoe: 0-915m; Alexander Selkirk: 0-1650m; Santa Clara: 0-375m

AREA 9,290ha

LAND TENURE 97% state property, 3% private (concentrated around San Juan Bautista).

PHYSICAL FEATURES The Archipelago is volcanic in origin and consists of steep and rugged mountain ranges with deep ravines. There are practically no flat areas. Various types of lava are found, some 400m deep. Robinson Crusoe Island (22km by 7km) has a 20km mountainous central ridge rising to 900m (El Yunque) and dividing arid treeless 'prados' (western) and moist-zone habitats. Santa Clara, lying 2km south-west of Robinson Crusoe, is dry and

uninhabited. Alexander Selkirk Island (11km by 6km) rises to a high plateau dissected by deep ravines with forest extending to about 700m and a peak of 1,650m (Los Inocentes). Vertical veins of basalt run through Robinson Crusoe Island and are continued through to the neighboring Santa Clara. The great block which apparently once formed the three islands, was split by an undersea eruption during the Tertiary period. The climate is maritime with average monthly temperatures fluctuating by less than 6°C (average 15.2°C). Annual rainfall 1289mm, 75% of which occurs during the winter. Average relative humidity 76.5%.

VEGETATION The islands are characterised by a variety of unusual growth forms and nearly 60% endemism among the vascular species. 146 species of native flowering plants have been recorded, including one endemic family (Lactoridaceae), ten endemic genera and 97 endemic species. The ferns and fern allies are represented by 54 species, 19 of which are endemic; Thrsopteris, one of four genera of tree-ferns, forms the endemic monotypic family Thyrsopteridaceae. There is also 67% endemism in phanerogams. Most spectacular is the evolution of the Compositae, the majority of which have a shrubby or arborescent growth-habit on the islands as compared with their mainland counterparts; out of 30 species, 28 are endemic, eg. the cabbage trees Dendroseris spp.. Temperate, but humid forests grow in the elevated parts of the islands and favour woody growth-habit in a number of families more commonly associated with herbaceous species eg. Selkirkia (Boraginaceae), Wahlenbergia (Campanulaceae), Chenopodium (Chenopodiaceae), Plantago (Plantaginaceae), Eryngium (Umbelliferae) and Boehmeria (Urticaceae). By contrast, two species of the composite genus Robinsonia have the unusual habit and habitat of epiphytes on tree ferns. Adaptive radiation occurs in Robinsonia and, more strikingly in Dendroseris, Phoenicoseris, Heperoseris and Rea. Other notable Fernandez genera showing speciation are Blechnum, Peperomia, Gunnnera, Haloragis, Eryngium, Solenum and Wahlenbergia. The distance between the islands of Robinson Crusoe and Alexander Selkirk has led to the marked insular confinement. Only 27 species of phanerogams are common to both islands. Of the endemics, 50% are confined to Robinson Crusoe, 33% to Alexander Selkirk, and 1% to Santa Clara. Among those restricted to Robinson Crusoe are two formerly economic species - the chonta palm Juania australis (R) and the native sandalwood Santalum fernandezianum (Ex). Also notable is Lactonis fernandeziana (E) which belongs to a primitive monotypic family and Yunquena terzii, which is only known from the 3ha summit area of El Yunque. According to Skottsberg (1952), the vegetation of Robinson Crusoe Island can be divided into the following communities: a steppe community (prados) consisting of Gramineae such as Stipa fernandeziana and Piptochaetium bicolor; an evergreen scrub community of Chilean myrtle Ugni selkirkii and the tree fern Blechnum cycadifolium; a sub-antarctic forest with Nothomyrica fernandeziana (the most wide-spread tree), Fagara mayu, Drimys winteri var. confertifolia, Juania australis, Berberis corymbosa and the Juan Fernandez apple tree Bohemeria excelsa in the lower reaches of the zone, and grading upward to associations such as Cuminia fernandeziana, C. eriantha, and Gunnera peltata. Alexander Selkirk Island is characterised by grasses and the Juan Fernandez tobacco Nicotiana cordifolia, the endemic umbellifer Eryngium sarcophylum and rare examples of hardwoods - Sophora fernandeziana (V), S. masafuerana (E) and Luma forest Myrceugenia fernandeziana, which are only known from Alexander Selkirk. There is also a temperate Magellanic element, particularly in the uplands of Alexander Selkirk, which includes Acaena spp., Drimys spp., Empetrum spp., Escallonia spp., Gunnera spp., Pernettya spp., Ranunculus spp., eg. R. caprarum (E possibly Ex), Rubus spp. and Ugni spp.. Santa Clara is treeless with Gramineae such as S. fernandeziana, P. bicolor, and the rare endemics Solanum robinsonianum, Dendroseris litoris and D. pruinata.

FAUNA There are a few native species and some introduced. The Juan Fernandez fur seal Arctocephalus philippi (V) is the most important mammal. Birds include the Juan Fernandez tit-tyrant Anairetes fernandezianus, the Juan Fernandez remolinera Cinclodes oustaleti, the masafura rayadito Aphrastura masafuerae, the masafuera eaglet Buteo polyosoma exsul, the Juan Fernandez hummingbird Sephanoides fernandensis, the Juan Fernandez buzzard Falco sparverius fernandensis and the nuco Asio flammeus suinda. The marine fauna is very rich and diverse, including the lobster Vasus frontalis (which sustains the economy of the island), the Juan Fernandez cod Hectoria oxygeneios, the atherine Basilichthys fernandezianum, the white sea-bass Scianea fasciata, horse mackerel Trachurus murphy and the hake Merluccius gayi.

ZONING/CONSERVATION MANAGEMENT In accordance with the management plan, the most important zone is the primitive one, followed by the intangible zone, the extensive use zone, the natural recuperation zone, the special use zone and the intensive use zone. In 1976, a management plan for the national park was published, setting out goals for the conservation of native biotic communities, scientific research, protection of landscapes, education, recreation and economic development through tourism. Successive local authorities have attempted to control erosion on the slopes near San Juan Bautista by reafforestation mainly with eucalyptus and conifers. Recently CONAF prepared a project outline incorporating both the control and eventual elimination of feral animals, and the cultivation and propagation of endangered plants ex situ, with a view to re-stocking suitable pilot areas. So far, this programme has had success with the propagation of the palm Juania austalis and species in the genera Berberis, Chenopodium, Sophora, Fagana, Dendroseris (sensu stricto) and Rea. The Juan Fernandez Archipelago is the focus of a project under IUCN/WWF's Plants Campaign Programme which would involve the assessment of wild populations of each native species, propagation of endangered species ex situ in nurseries and greenhouses, training in horticultural techniques, and livestock control. A public awareness programme will be initiated. CONAF has had a certain amount of success with the recovery of the Juan Fernandez fur seal from near extinction in the 1950s to a thriving population now in excess of 3,000.

STAFF One administrator, two rangers, ten permanent workmen and ten temporary workmen.

LOCAL ADMINISTRATION Corporacion Nacional Forestal(CONAF), V Region, 3 Norte 541, Vina del Mar.

VISITOR FACILITIES Tourism has been encouraged both as a function of the National Park and to ease economic dependence on the Juan Fernandez lobster. A road was to have linked the settlement with a small landing-strip in the south-west of Robinson Crusoe Island (see below) but visitors continue to be transported by boat.

SCIENTIFIC RESEARCH AND FACILITIES Annual returns of fauna are produced. According to the management plan, research priority is given to the study of the eradication or control of introductions, methods of erosion control and soil reclamation, plant succesion, inventory of flora and fauna, and habitat requirements of endangered species. IUCN/WWF Project 1410, begun in 1981, aims to continue studies on the seal population and to establish a conservation plan for the seal. The project will include censusing, tagging, land exploration to detect breeding areas, mapping, behavior and reproductive studies, and an education campaign. So far research is scarce, and has been in relation to the importance of the resources.

LOCAL POPULATION Robinson Crusoe Island - settlement of San Juan Bautista at Cumberland Bay in north east, outside park boundary; population 510 (1983). Alexander Selkirk Island - seasonal fishing settlement at Colonia in east occupied from October to May. Santa Clara - uninhabited.

MODIFICATION OF THE NATURAL ENVIRONMENT Serious threats from three sources. (1) Herbivorous mammals - goats, cattle, horses, donkeys, pigs, sheep, rats and rabbits - have all been introduced (in some cases as early as 1574) causing irreparable grazing damage. Most urgent needs are to reduce the numbers of feral cattle and sheep on Robinson Crusoe Island and goats on Alexander Selkirk Island. Other introduced animals include the coatimundi Nasua narica, the four-eyed sapito Pleuroderma thaul and the vineyard snail Helix pomatia. (2) Erosion caused by livestock grazing. This is the most serious threat and most difficult to control on the steep volcanic terrain. Some 46% of Robinson Crusoe island is considered affected especially in the east and round Cumberland Bay. Native forest survives in high ridges and steep ravines. In many other places bedrock is exposed. Regeneration is unlikely to occur because of the presence of weedy alien species. The decline of Luma forest on Robinson Crusoe Island has led to widespread repercussions proving detrimental to many species including the Juan Fernandez tit-tyrant, endemic to the island. In the late 1970s there was an attempt to construct a road across Robinson Crusoe, which was abandoned because of the environmental hazards involved. Similar erosion problems exist on Alexander Selkirk. (3) Alien flora. Introduced plants such as the Chilean Maqui Aristotelia chilensis and a bramble Rubus ulmifolious have become dominant and have extensively over-run plant communities. The native myrtle Ugni selkirkii is being rapidly replaced by the introduced U. molinas. On the dry treeless 'prados' of west Robinson Crusoe Island, several species of European grass and thistles are widespread. In addition to these 3 threats, there has been selective felling of native trees, especially of the chonta palm J. australis and the sandalwood tree S. fernandezianum, now thought to be extinct.

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Parque Nacional Torres del Paine

BIOGEOGRAPHICAL PROVINCE 8.37.12/8.11.02 (Southern Andean/Chilean Nothofagus)

LEGAL PROTECTION Total

DATE ESTABLISHED 13 May 1959 by Supreme Decree 383, and extended by Supreme Decree 90 (13 March 1975). April 1978 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Named after three rocky peaks in the Paine mountain mass, this park is located in the province of Ultima Esperanza, 142km north of Puerto Natales. Bounded to the north by Argentina, to the south by Puerto Natales, to the east by the Bernardo O'Higgins National Park, and to the west by cattle pastures; 49°21'-51°08'S, 73°07'-74°52'W.

ALTITUDE 200-2,346m, with a lot of the land over 2,000m.

AREA 184,414ha

LAND TENURE Owned by the Chilean government and administered by the National Forest Corporation (CONAF). There is a single private holding (Cerro Paine).

PHYSICAL FEATURES Torres del Paine lies between the Andes mountains and the Patagonian Steppe. A region of extensive plains gradually descending to the Atlantic, it is an area of most scenic beauty, with many ridges, crags, glaciers, waterfalls, rivers, lakes and lagoons. The Grey, Tyndall and Balmaceda glaciers are remains of a system once much more extensive. They are still retreating, the most spectacular retreat being that of the glacier feeding Lake Dickson (an average of 17m a year between 1897 and 1943). The climate generally is transandean to steppic. Annual precipitation ranges from 250-1500mm. There are strong winds in summer. Mean monthly temperatures in the Rio Paine sector range from 2.6-10.4°C but this area, having a distinct microclimate, cannot be considered as representative.

VEGETATION The tablelands and plains in the west are part of the Patagonian-Fuegian steppe. Those areas where lenga Nothofagus pumilio is present appear to be part of the evergreen forests of Verano, and extend to

the west as far as the foot of the mountains. The mountain areas belong to the alpine treeless zone. The following are the most widespread plant associations, arranged according to biotic province. Pre-andean scrublands: Pre-andean xerophytic scrub association, Mulinetum spinosi; mesophytic scrub association, Escallonietum rubri; dwarf shrub dysclimax association, Pernettyetum mucronati. Magellanic deciduous forests: Magellanic deciduous forest association, Nothofagetum pumilionis; Magellanic mixed forest association of Nothofagus pumilio and N. betuloides. Patagonian steppe: Patagonian steppe association, Festucetum gracillimi; association of Festuca gracillima and Baccharis magellanica; scrub association of Mata Negra, Verbenetum tridentis; also halophytic and meadow communities. Andean desert: desert and sub-desert communities.

FAUNA There are about 106 species of birds, some of which are endangered in Chile, such as Coscoroba coscoroba and Pterocnemia pennata. Agelaius thilius has only recently been discovered in the Cape Ultima Esperanza area. The most representative birds are Geranoaetus melanoleucus, Buteo polyosoma, Polyborus plancus, Campephilus magellanicus, Falco sparverius, Vultur gryphus, Falco peregrinus, Anas sibilatrix, Cygnus melancoryphus, Phoenicopterus chilensis. There are 24 species of mammals, 48% of those of the Magellan and Chilean Antarctic Region, two species of bat Myotis chiloensis and Histiotus montanus, the edentates Zaedyus pichiy and Chaetophractus villosus, the rodents Notiomys macronyx, Eligmodontia elegans, Phyllotis darwini and Euneomys petersoni, the canids Dusicyon griseus and D. culpaeus, the mustelids Conepatus humboldtii and Lincodon patagonica. The puma Felis concolor is a key species in the control of the population of smaller mammals, and is found in well-protected, wooded areas. Geoffroy's cat Felis geoffroyi is also present. There are about 570 guanaco Lama guanicoe in the park, and the southern huemul Hippocamelus bisulcus has disappeared from the area, but may be reintroduced. Among Amphibia are Bufo variegatus and Pleurodema bufonina, and among Reptilia Liolaemus lineomaculatus, L. magellanicus, L. dorbignyi, Diplolaemus darwini and D. bibroni.

ZONING/CONSERVATION MANAGEMENT The Management Plan distinguishes the following zones: primitive zone, extensive use zone, intensive use zone, regenerative zone, special use zone. All are available for scientific research. A management plan was published in 1975 which sets out the objectives of the Torres del Paine National Park.

STAFF One director, one chief park guard, seven park guards; three assistant guards, a chief and a technical assistant in environmental education, one ecologist and two other research workers, two landscape architects, one technician, 15 permanent workers, three drivers and several other miscellaneous employees.

LOCAL ADMINISTRATION Corporacion Nacional Forestal (CONAF), XII Region (Magallanes and Antarctica Chilena), Area de Ultima Esperanza, Casilla 41, Puerto Natales.

VISITOR FACILITIES There are visitor and information centres picnic areas and guided walks within the reserve. Access is not difficult.

SCIENTIFIC RESEARCH AND FACILITIES Research has already been carried out on a catalogue of the flora and fauna (including the actual distribution and situation of the species) and the preparation of an ecological map. Ecological research on the population of the guanaco Lama guanicoe and red fox Dusicyon culpaeus has been carried out, and an evaluation of the effect of the puma on the sheep remaining in the Park (Toro Lake area) has been made.

Research is currently being carried out on plant succession, reintroduction of Hippocamelus bisulcus, and the population structure of the European hare and its impact on the Park. Geological research and preparation of a geological map are proposed, and studies are planned on condor, eagle, Magellanic ostrich, Coscoroba swan, black-necked swan, flamingo and fish.

MODIFICATION OF THE NATURAL ENVIRONMENT Much has been damaged in clearing the land for rearing domestic stock. This is now being stopped and the lands are being restored. Two species have been introduced: Lepus europaeus and, to control it, Dusicyon griseus.

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Parque Nacional Laguna San Rafael

BIOGEOGRAPHICAL PROVINCE 8.10.2/8.11.2 (Valdivian Forest/Chilean Nothofagus)

LEGAL PROTECTION Total

DATE ESTABLISHED Established as a National Park by Decree 475 of 17 July 1959, 508 of 25 July 1967, 396 of 27 October 1970 and 320 of 1 June 1967. Accepted May 1979 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the province General Carrera and Capitan Prat provinces, 200km to the south west of the city of Coyhaique. Stretching from the Monte San Valentin (4,058m) to the western seaboard; 46°20'-47°55'S, 72°45'-75°30'W.

ALTITUDE 0-4,058m (Monte San Valentin)

AREA 1,742,448ha

LAND TENURE State property

PHYSICAL FEATURES An area of very varied topography and great scenic beauty. Includes the Continental Patagonian Range, the Insular Patagonian Range, the Patagonian Range with rivers and lakes, the Central Plain and the Patagonian Glaciers. It spans four ecological regions: the cold-temperate oceanic, the oceanic sub-antarctic, the oceanic trans-Andean, and the Andean. It contains 13 glaciers, one of which, the Glacier of San Rafael, descends to sea level,

the nearest glacier to the equator to do so in the southern Hemisphere. This glacier feeds the Laguna San Rafael, a large brackish lagoon where there have been past changes of water level of great scientific interest.

VEGETATION The vegetation is very varied and is in a virgin state in almost the whole of the park. At low altitudes (600-650m) there is a very luxuriant southern beech forest dominated by Nothofagus betuloides and N. nitida with rich and abundant undergrowth of shrub and tree ferns, and many epiphytes. Between 650 and 1,000m there is a sub-alpine forest of the two deciduous beeches N. pumilio and N. antarctica and an alpine zone between 1,000 and 1,300m. Round the Laguna San Rafael there are many peaty wetlands; and the moraines of different ages carry interesting stages of forest succession.

FAUNA The land fauna is relatively small but characteristic. Mammals include Pudu pudu, Felis concolor, Dusicyon culpaeus, Conepatus humboldtii, Felis guigna, Myocastor coypus, Lutra provocax, L. felina, Arctocephalus australis and Otaria bryonia. Birds include Cygnus melancoryphus, Anas sibilatrix, Fulica armillata, Chloephaga poliocephala, C. rubidiceps, Podiceps major, Phalacrocorax spp., Gabianus scoresbii, Larus dominicanus, Leptasthenura sp., Aegithaloides sp., Caracara plancus, Coragyps atratus, Milvago chimango, Parabuteo unicinctus, Curaeus curaeus, Microsittace ferruginea, Turdus falcklandii, Tachyneta leucopyga, Diuca diuca, Spinus barbatus, Casmerodius albus, Ardea cocoi, Megacerille torquata, Campephilus magellanicus, Colaptes pitius, Sephanoides sephanoides, Scekirchgilus rubecula, Pteroptochos tarnii, Tachyeres pteneres, Pyrope pyrope, Nycticorax nycticorax obscurus, Cinclodes patagonicus and Sylviorthorhynchus desmursii. There are various species of batrachians which have been neither studied nor identified. No reptiles have been seen in the park.

ZONING/CONSERVATION MANAGEMENT No management plan has yet been prepared and there is no zonation. Both are planned.

STAFF Four park keepers

LOCAL ADMINISTRATION Corporacion Nacional Forestal, XI Region, Cochrane 411, Casilla 412, Coyhaique.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The whole area is available for scientific research. Some studies of geology, palynology, limnology and vegetation succession were carried out in the 1950s. Priority will now be given to studies related to management: geology, glaciology, inventory of flora and fauna, vegetation succession, and the ecology of animals of special interest.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the area is completely natural; but unauthorized hunting of Lutra, Arctocephalus and Otaria has nearly exterminated them in the area. There are the remains of an attempt to construct a canal across the Ofqui isthmus. There is a gravel airfield close to the Laguna San Rafael.

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Parque Nacional Lauca

BIOGEOGRAPHICAL PROVINCE 8.36.12 (Puna)

LEGAL PROTECTION Total

DATE ESTABLISHED Established as Lauca Forest Reserve and declared a National Park on 11 August 1970 by Decree 270, of the Ministry of Agriculture. Accepted as a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION The Biosphere Reserve includes Lauca National Park, Las Vicunas National Reserve and Salar de Surire Natural Monument. In the extreme north of Chile in the province of Parinacota on Bolivian border, 160km east of Arica. 17°56'-18°72'S, 68°64'-69°40'E.

ALTITUDE 4,200-6,410m

AREA The Biosphere Reserve covers 358,312ha, Lauca National Park 137,883ha, Las Vicunas 209,131ha and Salar de Surire 11,298ha.

LAND TENURE 43% state-owned (fiscal), 57% ownership by local villagers.

PHYSICAL FEATURES Mountainous 'altiplano' landscape with volcanic mountain chains of Pleistocene and Holocene andesite rising above the Tertiary rhyolite plateau. The more recent volcanic strata cover part of the central zone and the western border of the park. There are important watersheds in the park with rivers flowing into the Pacific Ocean and down into Bolivia. Fluvial and glacial erosion are now less active. There are a number of permanent fresh, brackish and saline lakes including Salar de Surire and marshes, as well as fast flowing mountain rivers and streams. Arid climate with annual mean temperature of 1°C and mean annual precipitation of 335.5mm at 4,400m.

VEGETATION There are three principal plant formations, tolar, Andean steppe, and llaretal. Tolar is characterised by shrubs including Baccharis tola,

Fabiana spp., Chuquiraga spp., Parastrephia spp., Verbena spp. and Mutisia spp., with the tree Polylepis tarapacana and the cacti Opuntia spp. and Cereus spp.. The Andean steppe comprises perennial Andean grassland with Festuca acanthophylla, Stipa leptostachya and Stipa frigida, and 'bofedales dominated by rushes Oxycloe spp., as well as grasses, Gentiana prostata, Hipochoeris eriolaena and Hysela oligophylla. The llaretal is characterized by Laretia spp. with cushion-like specimens of Polylepis tarapacana.

FAUNA There is a diverse fauna, with seven faunistic types which can be seperated according to habitat (altiplano, freshwater lakes, rocky areas and high altitude grasslands). Mammals include various rodent species yet few carnivores. Present in the park are guanaco Lama guanicoe, domestic llama Lama glama, domestic alpaca Lama pacos, vicuna Vicugna vicugna and northern huemul Hippocamelus antisensis. The park has a very rich and varied avifauna (150 species), with large numbers of most of the typical high Andean waterfowl. There is a very high population of the giant coot Fulica gigantea (several thousand birds). Torrent duck Merganetta armata are common on the rivers; puna plover Charadrius alticola, tawny-throated dotterel Eudromias ruficollis, Mitchell's plover Phegornis mitchellii, andean avocet Recurvirostra andina, Andean gull Larus serranus and rufous-bellied seedsnipe Attagis gayi breed, and horned coot Fulica cornuta also occur. All three Andean species of flamingo occur in large numbers at Salar de Surire. Several Nearctic shorebirds occur during the austral summer.

ZONING/CONSERVATION MANAGEMENT Historic/cultural zone 48%, extensive use zone 18.2%, unmodified zone 17.2%, intensive use zone 9.4%, restoration zone 5.2% and special use zone 2%.

STAFF Total of 13: three research and ten administration

LOCAL ADMINISTRATION Direccion Regional, Corporacion Nacional Forestal, Maipu 333, Casilla 1484, ARICA.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Studies in the park have included plant associations, physical characteristics of the area, archaeological research and management of the vicuna, alpaca and lama. Future studies will include further work on the fauna, and on the impact of man and of grazing. Monitoring activities involve meteorology, water flow in the River Lauca and population dynamics of vicuna, guanaco, northern huemal and rhea. The park has an active environmental education programme.

MODIFICATION OF THE NATURAL ENVIRONMENT There is a proposal to use the waters of Lake Chungara for irrigation in the Azapa Valley, the current intention (as of 15 February 1985) being to extract eight million cubic metres of water per annum. The affect this might have on the bird populations of the lake is unclear, but the lake supports the largest breeding population of the giant coot in Chile, and possibly in the world. Erosion has been caused by some tree-felling connected with the construction of the Arica-La Paz railway line and the building of a canal in the park for a hydro-electric project and irrigation. The altiplano areas in the park are used by local pastoralists.

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Reserva de la Biosfera 'Araucarias'

BIOGEOGRAPHICAL PROVINCE 8.22.05 (Chilean Araucaria Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1983. Conguillio was established under Decree 1117 of 26 May 1950 while Los Paraguas was created in 1940 (Decree 1682 of the Ministry of Lands and Colonization). Alto Bio-Bio was set up in 1912 by the Ministry of Foreign Relations.

GEOGRAPHICAL LOCATION Conguillio-Los Paraguas is in the province of Cautin; 38°40'S, 71°42'W, Alto Bio-Bio is 120km from the city of Victoria in the province of Matteco, approximately 230km to the East of Conguillio-Los Paraguas.

ALTITUDE 800-3,124m

AREA The Biosphere Reserve covers 81,000ha, Conguillio occupies 28,000ha, Los Paraguas 18,000ha and Alto Bio-Bio 35,000ha.

LAND TENURE Fiscal except for 5%

PHYSICAL FEATURES Situated in the Andean mountain range and including an active volcano with a double crater (which last erupted in 1957). There are vast extensions of lava and the system of lakes, lagoons and rivers are extremely scenic. Alto Bio-Bio has a high terrain with a mixture of undulating hills strongly dissected by deep canyons of glacial origin, and volcanic mountains. The climate is rigorous with precipitation close to 2800mm per year in Conguillio-Los Paraguas and 3000mm in Alto Bio-Bio. Mean annual temperature is 8.5°C and 7°C respectively.

VEGETATION Predominantly mixed woodland of Chilean pine Araucaria araucana with four species of Nothofagus located in the transition zone. Podocarpus andinus and Austrocedrus chilensis are also found. The smaller plant species are sparce, and consist principally of Berberis sp., Chusquea sp., Ugni molinae and Festuca sp..

FAUNA The fauna is of low diversity. Interesting mammals are pudu Pudu pudu, kodkod Felis guigna, puma F. concolor, guanaco Lama guanicoe and fox Dusicyon sp.. The very rare marsupial Dromiciops australis occurs within the reserve. Both the avifauna and herpetofauna are very rich due to a wide range of

habitats along the altitudinal gradient of 800 to 3,100m. Among birds, the presence of Vultur gryphus, Campephilus magellanicus and Enicognathus leptorhynchus is of note.

ZONING/CONSERVATION MANAGEMENT There is a preliminary single management plan for Los Paraguas and Conguillio which makes most of the area a primitive zone, and includes a natural recuperation zone, an intangible zone, an intensive use zone and an extensive use zone. Los Paraguas and Conguillio together provide a natural core zone, and the Alto Bio-Bio reserve constitutes a buffer.

STAFF One administrator and four park guards. The biosphere reserve staff totals 11.

LOCAL ADMINISTRATION Santiago Gomez L., Corporacion Nacional Forestal, IX Region, Lautaro 853 Temuco.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There are possibilities for significant studies of the connection between geomorphology and vegetation. Currently the reintroduction of native animals, particularly the guanaco Lama guanicoe, is being studied. There is one centre for the study of native fauna in the park. Access to Alto Bio-Bio is difficult.

LOCAL POPULATION The Alto Bio-Bio National Reserve (buffer zone) has a pastoral population of about 20 families.

MODIFICATION OF THE NATURAL ENVIRONMENT There is some disturbance from neighbouring properties, and in some sectors it is relatively extensive with the outbreak of forest fires, especially in the Los Paraguas region. ENDESA is reportedly planning a large hydroelectric project which would include a dam and artificial lake.

PRINCIPAL REFERENCE MATERIAL

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Republica de Chile, Ministerio de Agricultura (1985). Estadisticas Sobre Areas Silvestres Protegidas de Chile (1985).

Reserva de la Biosfera La Campana-Penuelas

BIOGEOGRAPHICAL PROVINCE 8.23.06/8.11.02 (Chilean Sclerophyll/Chilean Nothofagus)

LEGAL PROTECTION Total

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1984. La Campana was established in 1967 (Law 16.699); Lago Penuelas became a reserve in 1981.

GEOGRAPHICAL LOCATION La Campana is located in the province of Quillota, 40km from the city of Vina del Mar; approximately 33°S, 71°15'W. Lago Penuelas is located 33°10'S, 71°32'W, near Quilque.

ALTITUDE 1,900-2,222m in La Campana. Lago Penuelas has an altitude of 335m.

AREA 17,095ha, La Campana National Park covers 5,328ha and Lago Penuelas 9,094ha.

LAND TENURE While La Campana is mainly privately owned, Lago Penuelas is state-owned.

PHYSICAL FEATURES La Campana contains hills ranging from 1,900m to 2,222m in height, generally with a north exposure. Lago Penuelas is a permanent fresh-water lake with associated marshes, fast-flowing streams and some seasonally inundated grasslands.

VEGETATION Sclerophyllous woodlands in the semi-humid region of the central zone, with Cryptocarya alba and Peumus boldus. In the more humid areas is hydrophilous woodland with Drimys winteri and Persea lingue. The presence of Jubaea chilensis is noteworthy.

FAUNA Important species are red fox Dusicyon culpaeus and Lagidium viscacia. Among the birds are Mivalgo chimago, wild pigeon Columba araucana and Sephanoides sephanoides, but in general the diversity is poor. Lago Penuelas is an important area for Anatidae.

ZONING/CONSERVATION MANAGEMENT None yet established. A definitive planning scheme is scheduled for 1981.

STAFF La Campana has an administrator, three park guards and six watchmen.

LOCAL ADMINISTRATION Ricardo Meza, Director Regional V Region, Corporacion Nacional Forestal, Vina del Mar.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Plants and animals have been studied, specifically in their relationship to the climate of La Campana. The University of Chile Geography Department has a meterological station in La Campana.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the land of La Campana is privately owned, but as there is no chance for it to be used for agriculture it has remained largely unaltered. Copper mines, however, have damaged the vegetation and terrain in two areas of La Campana.

PRINCIPAL REFERENCE MATERIAL

Ahumada, Miguel (1981). Zoning for La Campana National Park. National Forestry Corporation, V Region Vina del Mar, Chile.

Changbai Mountain Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.14.05 (Manchu-Japanese Mixed Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED Established as a Nature Reserve in 1960 under National Law for the Protection of the Environment. Accepted as Biosphere Reserve in 1979.

GEOGRAPHICAL LOCATION The reserve is situated around Beitou mountains in the south-east of Jilin province in Antu, Fusong and Changbai counties, the southern and south-eastern parts bordering on Korea. About 50km from the town of Tonghua; 41°43'-42°25'N, 127°38'-128°17'E.

ALTITUDE 720-2,691m

AREA 217,235ha

LAND TENURE State

PHYSICAL FEATURES The park is in a spectacular mountainous region, with snowcaps on the highest peaks giving it the name 'Changbai', or ever white. The mountains were formed about 12 million years ago by faulting and by three periods of volcanic activity ending about two million years ago. However, several eruptions in 1507, 1668 and 1702 may mean the volcanoes are only dormant. The largest crater now contains a lake called Sky Lake which is 373m deep and has an area of 980ha. It is surrounded on three sides by a horseshoe of peaks, the highest being Baiyun, 2,691m. On the northern side the lake outflow turns into the Changbai waterfall, 38m high, the source of the second Songhua river. The other rivers, the Yalu and Tumen, have their sources on this mountain block and there are many hot springs, one with a temperature of 82°C. At the foot of the mountains, below about 1,000m, is a flatter plateau of lava. Temperatures are cool, decreasing markedly with altitude and annual precipitation is over 1000mm.

VEGETATION The great range of altitudes in the reserve means that it has a series of five well-defined vegetation zones, unique on the east coast. The flatter areas below 1,100m have mixed coniferous and broadleaved forest with Korean pine Pins koraiensis, Manchurian ash Fraxinus mandshurica, Phellodendron amurense, Larix olgensis, Picea asperata and Panax ginseng. On the steeper slopes of the mountains is coniferous forest and above this from 1,800 to 2,000m there is Erman's-birch Betula ermanii elfin woodlands. Above the tree line at 2,000m there is subalpine evergreen ericaceous shrub including Vaccinium uliginosum and Lycopodium alpinum. The highest parts have alpine tundra. In the hot spring areas only Ophioglossum vulgatum survives. The vegetation is a mixture of plants from Europe and Siberia like Linnea borealis and Alnus hirsute together with those more commonly found in central China, such as Actinidia kolomikta, A. arguta and Shizandra chinensis. Manchurian walnut Juglans mandshurica also occurs. Over 1,800 species of vascular plants have been recorded, 800 of economic value.

FAUNA The fauna of the reserve and surrounding area belongs to the Changbai subregion of the ancient boreal region with an obvious vertical zonality. Mammals include horseshoe bat Rhinolophus ferrumequinum, whiskered bat Myotis mystacinus, pipistrelle Vespertilio savii, brown bear Ursus arctos, Asiatic black bear Selenarctos thibetanus, sable Martes zibellina, yellow throated marten Martes flavigula, weasel Mustela sibirica, otter Lutra lutra, lynx Felis lynx, leopard cat Felis bengalensis, leopard Panthera pardus, wild boar

Sus scrofa, Siberian musk deer Moschus sibiricus, red deer Cervus elaphus, sika deer Cervus nippon, roe deer Capreolus capreolus, goral Nemorhaedus goral, pika Ochotona alpina, chipmunk Tamias sibiricus and red squirrel Sciurus vulgaris. North East Asian tiger Panthera tigris longipilis (E), the largest tiger subspecies in the world, occurs in the reserve and is no longer found elsewhere. There are nearly 200 species of migrant and passage birds including black grouse Lyrurus tetrix, hazel grouse Bonasa bonasia, quail Coturnix coturnix, ringnecked pheasant Phasianus colchicus, mandarin duck Aix galericulata, black stork Ciconia nigra and Chinese merganser Mergus squamatus (I), a newly discovered species. Reptiles include Agkistrodon halys. The 300 amphibians and reptiles include Rana temporaria. Fish include Brachymystax lenok.

CULTURAL HERITAGE The Cangbai Mountains are looked on as the homeland of the Manchu nation which ruled China as the Qing Dynasty from 1644-1911. A fairy who bathed in the Sky Lake was supposed to have given birth to their original ancestor.

ZONING/CONSERVATION MANAGEMENT Around Sky Lake there is a core zone 133,841ha and buffer zone of 83,394ha. A forest reserve, used for timber extraction, around the biosphere reserve acts as an additional buffer. A management plan has been prepared. The local population is closely involved with conservation matters, assisting in maintenance and fire prevention. All activities are prohibited in the core zone and hunting banned in the buffer zone.

STAFF Total staff of 244: 72 protection, 28 professional, 12 construction workers and 132 support workers.

LOCAL ADMINISTRATION Changbai Mountain Nature Reserve Bureau, Tonghua, Jilin Province.

VISITOR FACILITIES There are about 40,000 visitors from spring to autumn. The hot springs are an attraction, and baths have been developed using water from these. Gravel roads and hotels have been built within the reserve. There is a tenting area at the reserve boundary but not inside.

SCIENTIFIC RESEARCH AND FACILITIES There are some 15 current research projects under MAB Project 2 on the structure and function of temperate forest ecosystems. Required research includes increasing the endemic deer populations and protecting the North East Asian tiger. It is hoped that a number of collaborative projects will be initiated between Chinese and U.S. Scientists on temperate forest ecosystems. The Academia Sinica maintains an experimental station with 50 researchers close to the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT There has been timber extraction in the buffer zone, 10,000ha having been clear felled, and seed collection occurs here. There was a lack of centralised administration reported (Chao Ching Ju, 1984) resulting in exploitation by different departments: tourism, physical trainng, power supply, etc. Roads, hotels, power stations and other facilities have therefore been built within the reserve. Some tourists damage the environment and conservation education needs to be increased generally in China, as suggested by the Forestry School of China in conjunction with MAB at a national seminar. This session also agreed that funding should be increased (Chao Ching Ju, 1984).

PRINCIPAL REFERENCE MATERIAL

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Dinghu Nature Reserve

BIOGEOGRAPHICAL PROVINCE 4.06.01 (South Chinese Rainforest)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established in 1956 under the National Law for the Protection of the Environment and accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION In Guangdong province, about 84km from the town of Kuanchou. 23°10'N, 112°34'E.

ALTITUDE 100-1,000m

AREA 1,200ha

LAND TENURE State government

PHYSICAL FEATURES This is a hilly area with shale and sandstone bedrock of Devonian age with frequent steep slopes. There is a 40m high waterfall within the reserve. Soils are zoned according to altitude, from lateritic red earths, yellow earths to mountain soils and have high organic contents. Climate is warm and humid with average relative humidity of 80%. Average annual temperature is 21.4°C and average temperature of the coldest month (January) 12.1°C. Annual rainfall varies from 1600-2200mm with distinct wet and dry seasons, 80% falling between May and September.

VEGETATION The range of altitudes means that there are several vegetation zones: subtropical monsoon evergreen broadleaved forest, containing Lauraceae and Fagaceae; ravine forest and dominated by Castanopsis chinensis and Cryptocarpa concinna; subtropical evergreen broadleaved forest; broadleaved-coniferous mixed forest; shrub forest and shrubby grassland. There are about 2,110 species of higher plants. Although the broadleaved forest is transitional between tropical and subtropical, many typically tropical families are lacking, such as Dipterocarpaceae. The Quaternary

glaciation did not affect this region markedly and there are many relict species including Ginkgo sp.. Several species of tree ferns grow, mainly in ravines, including Cyathea podophylla, C. gigantea and C. spinulosa.

FAUNA The subtropical species typical of this ecosystem include serow Capricornis sumatraensis, leopard Panthera pardus (V), silver pheasant Lophura nycthemera and greyheaded woodpecker Picus canus. About 120 bird species, 38 mammal and 20 snake species, have been recorded.

CULTURAL HERITAGE The forest has been conserved for over 400 years and there is a large ancient temple at the edge of the forest, on the mountain.

ZONING/CONSERVATION MANAGEMENT Core zone 270ha, buffer zone 950ha This is carried out by staff from Dinghu-Shan Arboretum. The larger, western part of the reserve is used for conservation and research while in the eastern part tourism, recreation, religion and education are catered for. Some timber felling is allowed in the latter, but local villagers are being encouraged to plant fast-growing trees near villages to reduce this pressure. In cooperation with Xiaoliang hydrological station 13,000ha of fuel forest, mainly indigenous species, have been developed since 1958. This has helped prevent soil erosion as well as providing wood. Since the 1950s there has been a lot of work on conservation education locally, using the media and schools.

STAFF 25 protection and maintenance staff

LOCAL ADMINISTRATION Dinghu-Shan Arboretum, South China Institute of Botany, Academia Sinica, Shao-ging, Kwantung.

VISITOR FACILITIES Many people visit the ancient temple as well as the forest areas. There are posters and booklets about the reserve. Visitors have access to the eastern part.

SCIENTIFIC RESEARCH AND FACILITIES 30 researchers conducting ten research projects in the area on the structure and functioning of subtropical forest ecosystems as part of MAB Project 1. In 1981, links were formed with a north-east Australian research station under the MAB Project. The Dinghu-Shan Arboretum was established in 1956 where many botanical studies have been conducted. Facilities at the experimental station established by the Botanical Institute of China (Academia Sinica). In 1979 a new centre, Dinghu-Shau Forest Ecosystem Station, was established in connection with the MAB Project, and research has broadened to include zoology, meteorology, soils and geography. There is a meteorological observation tower.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the reserve is in a virgin state, the eastern part being somewhat disturbed by tourism and limited local use.

PRINCIPAL REFERENCE MATERIAL

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Wang, Z. (1985). Ding Hu Shan Biosphere Reserve. People and Protected Areas in the Hindu Kush-Malaya. King Mahendra Trust for Nature Conservation and International Centre for Integrated Mountain Development, Nepal.

Wolong Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.39.12 (Szechwan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established in 1975 as Forestry Reserve, under the National Law for the Protection of the Environment and expanded to its present size in 1978. Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION In Szechuan province, 136km from Chengdu, adjoining Jiuzhaigou Reserve; 30°46'N, 102°50'E.

ALTITUDE 1,155-6,250m

AREA 207,210ha

LAND TENURE Government ownership except for 400ha along the Pitiao and Erher rivers owned by the communitities of Gengta and Wolong.

PHYSICAL FEATURES The reserve is extremely high and mountainous, uplifted at the same time as the Himalaya and deeply eroded by rivers and glaciers, the highest peaks having permanent snowcaps. The area was glaciated in the Quaternary and there are features such as cirques and glacial lakes. Rock types are varied, with limestone and phyllite most common. The climate is Tibetan, with long winters, snow and near freezing temperatures from November to March and cool, clowdy summers. Temperatures also decrease markedly with altitude within the reserve. Annual precipitation is over 1000mm, most falling from June to October, associated with the south-east monsoon.

VEGETATION The vegetation is the most of any reserve in the biosphere network, due to the 5,000m range of altitudes. There are a number of distinct zones comprising: subtropical evergreen forest (up to 2,000m), deciduous broadleaved and coniferous mixed forest (2,000-3,000m), coniferous forest mainly Abies spp. (3,000-3,700m), larch forest, alpine meadow and arctic tundra (above 3,700m). Different bamboo species in the understorey at different altitude. Below 1,600m the main ones are Phyllostachys nidularia and especially Sinarundiraria ferax while from 1,600m to 2,000m umbrella bamboo Fargesia spp. are dominant. From 2,000m to 2,600m the Fargesia is accompanied by S. chungii and S. fangiana locally. The most extensive forests are between 2,600m and 3,600m, covering 31,700ha and S. fangiana is dominant here with S. chungii common in some areas.

FAUNA Wolong is the largest and most important reserve for the giant panda Ailuropoda melanoleuca (R) (145 in 1974; 200 reported in 1983) and one of only two reserves with viable populations. The fauna is allied to both the Oriental and Palaearctic regions. Animals of oriental origin include giant and red panda Ailurus fulgens, clouded leopard Neofelis nebulosa (V), serour Capricornis sumatraensis, shrimp-tailed macaque Macaca thibetana, bamboo rat Rhizomys sinense and golden pheasant Chrysolophus pictus. Those with Palaearctic affinities include snow leopard Panthera uncia (E), forest musk deer Moschus berezovskii, pika Ochotona thibetana, steppe cat Felis manul and snowcock Tetraogallus tibetanus. Other completely protected species include golden monkey Rhinopithecus roxellanae, takin Budorcas taxicolor tibetana (I), white-lipped deer Cervus albirostris (I) and green-tailed monal Lophophorus lhuysii. Over 230 bird species, 96 mammal, 20 reptile, 14 amphibian and six fish species have so far been recorded.

ZONING/CONSERVATION MANAGEMENT Strictly protected core zone 50,000ha and less protected buffer zone about 150,000ha. The reserve's primary aim is to conserve the giant panda and its habitat. Since 1979 WWF has been collaborating with several Chinese institutions to investigate management possiblities. Much research was carried out in the early 1980s including ecological studies using radio tracking. In February 1985 an IUCN mission visited China to advise WWF and the Chinese government on the next phase of conservation. A five-point plan of action was agreed upon: a detailed ecological study of pandas; bamboo distribution surveys; socio-economic factors affecting the animals and their food could be studied; reserve personnel given special training; an overall plan for managing panda habitat to be prepared, including a demonstration management plan for Wolong. Several of these were underway in 1986 including discussions of Wolong's management plan at a joint WWF-Forestry Ministry workshop in July 1986. WWF/IUCN project 1929 is supporting additional research into captive breeding, artifical insemination, emergency dietary substitutes and additional fieldwork. The core zone is strictly protected from all but scientific work but some timber removal and hunting occurs in the buffer zone. About half of the local population are scheduled to be resettled from 1984-1986.

STAFF Total staff of 33 including 26 professional

LOCAL ADMINISTRATION Wolong Natural Reserve, Chen Du, Szechuan Province.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Between 1974 and 1977, censuses of the panda population were carried out by 3000 people. Following the bamboo shortage in 1975, research into giant panda preservation was stepped up. In 1982 a comprehensive programme of research was begun by Chinese researchers and WWF to study in detail the panda's natural history and the ecology of the various species of bamboo it relies on for food. A number of pandas were fitted with radio collars to provide information about their habitat usage. A research and conservation centre was set up in the reserve at Wuyipeng and fieldwork camps set up at an altitude of 2,400m. Vegetation and soil surveys were also undertaken.

LOCAL POPULATION About 3,000 people, mainly Qiang of Tibetan stock, inhabit the main valley in Wolong, growing potatoes and maize and other crops. About half of these were to be resettled between 1984 and 1986.

MODIFICATION OF THE NATURAL ENVIRONMENT Giant panda habitat in China is now extremely fragmented and only two or three reserves contain viable populations of over 100 individuals; even larger populations are probably necessary for long-term genetic diversity. A small number of pandas are caught in deer traps. The several species of bamboo which form 99% of the pandas' diet have a mass flowering every 40-120 years when most plants of a particular species flower, then die. Umbrella bamboo did this in the late 1920s, probably causing about 150 out of China's 1,000 pandas in reserves to die. In May 1983, over 90% of arrow bamboo in Wolong flowered, forcing Pandas to forage on umbrella bamboo at lower altitudes. Fragmentation of the giant panda's range makes it more difficult for it to find alternative food during bamboo shortages. An earthquake affected the area in 1976, causing landslips and disturbing vegetation. Logging began in 1916, with a peak between 1961 and 1975 but since then, has completely stopped; tree clearance affects bamboo growth, even selective logging.

PRINCIPAL REFERENCE MATERIAL

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Cinturon Andino Cluster Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 8.33.12 (Northern Andean)

LEGAL PROTECTION Protected under Ordinance Nos. 92-VII-1968 and 13-V-77 and Presidential Decree No. 2631 of November 1960.

DATE ESTABLISHED Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION In the counties of Cauca, Huila and Tolima. Includes Puracé, Nevado del Huila and Cueva de los Guacharos National Parks. 2°48'N, 75°57'W.

ALTITUDE 1,700-5,750m

AREA 855,000ha, Puracé covers 376,875ha, Huila 399,125ha and Guacharos 90,000ha.

LAND TENURE 28% state ownership, 72% private ownership.

PHYSICAL FEATURES A high mountainous area corresponding to the northern ranges of the Cordillera de los Andes with the sources of the Magdalena, Cauca and Caqueta rivers. There are several active volcanoes including Nevado del Huila rising to 5,570m and many craters, hot springs and volcanic lakes. The Guacharos area is characterized by great canyons formed by the River Suaza and by huge caves containing many unusual geological formations; in the west, there are Jurassic-Triassic cliffs in the Negra canyon. Climate varies with altitude with average temperature usually 0°C to 10°C and annual average rainfall 1,200 to 2,500mm.

VEGETATION Vegetation varies according to altitude from subtropical rainforest, low montane and montane cloud forest and heathland "parano" up to the perpetual snowline. The forests of the Cueva de los Guacharos area contain species such as Podocarpus, Cedrela, Juglans, various palms and many orchids. Of particular interest is Trigonobalanus excelsa, discovered and scientifically described from samples taken in Los Guacharos. Associated with the oak forests are smaller species such as laurels Ocotea cuneata and Nectandra macrophylla, types of fruit bearing shrubs such as Weinmannia spp. and bushes such as Viburnun cornifolium, Psychotria alba and Palicourea paradisiaca. The Puracé region contains trees and shrubs such as Opuntia pittieri, Latoensia speciosa, Weinmannia spp., Quercus humboldtii and Chusquea spp., areas of "frailejon" Espeletia hartwegiana and large expanses of scrubland, bamboo and reeds. Also found in Puracé are laurels Myrica pubescens as well as Ardisia sapida, Grammadenia alpina, Eugenia spp. and Myrcia spp. and over 200 species of orchids.

FAUNA The area is particularly rich in birds species which number some 267. Amongst these are Andean condor Vultur gryphus, American collared sparrow hawk Accipiter collaris and cock of the rock Rupicola perunana. Of special interest is the oilbird Steatornis caripensis found in one cave. Also of interest is the Tinanus osgoodi hershkovitzi which is an endemic to the park, the Northocercus julius and toucan Aulacorynchus prasinus. Mammals include spectacled bear Tremarctos ornatus, mountain tapir Tapirus pinchaque, capuchin monkey Cebus apella, anteater Tamandua tetradactyla and ocelot Felis pardalis. Also found here are brocket Mazana americana, pudu Pudu mephistophiles and jaguar Panthera onca amongst others.

ZONING/CONSERVATION MANAGEMENT Core area 605,000ha and buffer zone 250,000ha.

STAFF Puracé: 25 staff (one executive, four administrative and 20 general service); Huila: six staff (one professional, one administrative and four general service); Guacharos: nine staff (one professional, one technical, one administrative and six general service).

LOCAL ADMINISTRATION Puracé: Celedonia Rozo Millan, Calle 4a No. 4-38, Popayan. Guacharos: INDERENA, Pitalito, Huila, Colombia; Huila: INDERENA, Neiva.

VISITOR FACILITIES The Puracé Reserve has a tourist recreation area at the entrance and 3 overnight cabins at an altitude of about 3,300m at San Juan hot springs. There are also footpaths leading to sites of special interest. Access to Cueva los Guacharos is by mule.

SCIENTIFIC RESEARCH AND FACILITIES Studies have been carried out (mainly for tourist interpretative guidebooks) on: birds of the Puracé and Cueva de los Guacharos Reserves; vegetation of the Cueva de los Guacharos Reserve; flora of the Puracé Reserve; and sulphur deposits in the Cinagre Mine, Puracé. There is no biological research station in the area.

MODIFICATION OF THE NATURAL ENVIRONMENT Some modification of the low-lying areas, mainly in the Nevado del Huila Reserve, otherwise in a natural state.

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El Tuparro Nature Reserve

BIOGEOGRAPHICAL PROVINCE 8.27.10 (Llanos)

LEGAL PROTECTION Protected under Ordinance No. 19, August 1970 of the Board of Directors of INDERENA (Instituto de Desarrollo de los Recursos Naturales Renovables).

DATE ESTABLISHED August 1970 as a Faunal Reserve. Accepted as a Biosphere Reserve in November 1979. 1980 as a National Park, with an increased area.

GEOGRAPHICAL LOCATION In the eastern plains of Colombia in Vichada county. 5°00'-34'N, 67°52'-69°10'W.

ALTITUDE 80-315m

AREA 928,125ha The National Park covers 548,000ha.

LAND TENURE 99.9% is owned by the state; the remaining 0.1% came from settlers' property added to the reserve in 1980 during its enlargement.

PHYSICAL FEATURES A flat area bounded by the Orinoco river to the east, the Tomo river to the north and the Tuparro and Tuparrito to the south. The western boundary follows the La Hormiga river descending towards the river Tomo and the Jsnipa towards the Tuparrito. The area undulates with a series of small valleys and the flow of major rivers and streams is west to east. There are a few granite boulders towards the east of the park. A few areas are permanently flooded during parts of the year. The average annual temperature is about 28°C and average annual rainfall is 2200mm.

VEGETATION 85% of the area is covered with natural grass savanna, dominated by plume grass Andropogon bicorne, Paspalum spp. and Stipa spp.. Woodlands are found along the water courses, with tree species such as Tabebuia spp., Guarea kunthiana, Curatella americana, Bowdichia virgiloides, Byrsonima sp., Caraipa llanorum, Calophyllum spp., Couma macrocarpa, Jessenia polycarpa, Tecoma sp., boursera spp., Hymenaea coubaril and Bombax spruceanum. Especially notable is the "Morichales" formation, of Mauritia flexuosa. In the so-called "mirity areas", the mirity palm, Mauritia minor is found.

FAUNA Mammals of the savanna include white-tailed deer Odocoileus virginianus, giant armadillo Priodontes maximus, small savanna armadillo Dasypus sabanicola, tapir Tapirus terrestris and dog fox Cerdo cyonthons. The woodlands are inhabited by peccaries Dicotyles tajacu, pumas Felis concolor, jaguars Panthera onca and different species of monkeys. Noteworthy birds include guans Penelope jacquaçu, curassows Crax spp., screamers Chauna chavaria, eagles Aquilla spp., cock of the rock Rupicola rupicola and ducks. Giant otters Pteronura brasiliensis (V), capybaras Hydrochaeris hidrochaeris, orinoco crocodile Crocodylus intermedius (E), Eunectes murinus, caiman Czaiman crocodilus and turtles are found along the shores of the rivers, which abound with fish including piranha Serrasalmus spp. and electric eel Electrophorus electricus.

ZONING/CONSERVATION MANAGEMENT Core area of 600,000ha; buffer zone of 328,125ha.

STAFF There are 23 staff members for supervision and management: two professional, three administrative and 18 general service.

LOCAL ADMINISTRATION Dr Eduardo Torres Conde, Calle 34 No. 13-96, INDERENA, Bogota.

SCIENTIFIC RESEARCH AND FACILITIES INDERENA is varrying out the following research: study of plant formations of the area, ecological studies on white-tailed deer and paca Agouti paca, zoning of the reserve, and a preliminary inventory of the fauna. There is a small biological research station within the reserve. The reserve also contains an administrative centre and two landing strips. A road is open throughout the year for access to the Tapon cabin and the administrative centre is easily accessible by road during summer. There are other roads leading to places of interest.

LOCAL POPULATION A seninomadic group of Indians, the Guahibos still live in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Largely untouched by man, except for small areas which have been burnt in the past by Indians but are now returning to their natural state.

PRINCIPAL REFERENCE MATERIAL

INDERENA, FEN, FEN COLOMBIA (1984). Colombia Parques Nacionales. INDERENA Bogota, 262pp.

Sierra Nevada de Santa Marta (including Tayrona National Park)

BIOGEOGRAPHICAL PROVINCE 8.17.04 (Venezuelan Dry Forest)

LEGAL PROTECTION Protected under Ordinance No. 25 of May 1977 of the Board of Directors of Inderena and Decree No. 292, 1969.

DATE ESTABLISHED 1964. Extended in 1977 as a result of Joint Directive between INDERENA No. 25 of May 1977 and Executive Resolution No. 292 of 1969. Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION In the extreme north of Columbia in the departments of Magdalena, Guajira, Cesar and Litoral Caribe. Most of the Reserve (675,000ha) lies in the Sierra Nevada de Santa Marta and the remaining 56,250ha comprise Tayrona National Park. 11°18'N, 74°10'W.

ALTITUDE 0-5,879m

AREA 731,250ha, of which Tayrona covers 56,250ha.

LAND TENURE State ownership 33%, private ownership 67%.

PHYSICAL FEATURES Due to wide altitudinal range, all major climatic zones of Columbia are found. The area stretches from the Carribean coast with a finely preserved coral reef, extensive beaches, several bays and inlets up to the Sierra Nevada de Santa Marta with marked relief and steep slopes. The area includes springs of several important rivers including El Cesar, Don Diego, Palomino, Aracataca and Tucurinca. The park contains the highest mountain in Colombia, Simon Bolivar and the summits are covered with perpetual snow. The snowy peaks called "chundua" are considered sacred. There is evidence of glaciation such as U-shaped valleys, terminal moraines and polished rocks.

VEGETATION Vegetation ranges from subhygrophyte to snow levels and includes cloud forest and high barren plains. Species include: Prosopis juliflora, Bulnesia arborea, Bursera simaruba, Caesalpinia ebano, Albizzia colombiana, Samanea saman, Enterolobium cyclocarpum. The paramos is characterised by Espeletia glossophyllum and E. subnerifolia, trees up to 5m high, which, like all the biotic elements, strongly resemble Sierra de Merida vegetation. In Tayrona three types of vegetation are to be seen: forest/matorrales with Prosopis julliflora, Acacia tortusa and A. farnesiana, Haematoxylon brasiletto, Ceasalpinia coriaria and Apuntia wentiana; dry forest with Enterolobium cyclocarpun, Spondias mombin, Crataeva tapia, Bulsenia arborea and Pseudobombax maximum; and humid forest composed of Scheelea magdalenica, Sabal mauritiiformis, Caludonica palmata and Desmoncus sp. Dominant species in the treetops are Anacardium excelsum and Brosimum sp. Other important species are Ocotea sp., Nectandra sp., Paulsenia armata and Aspidosperma megalocarpon.

FAUNA Mammals include puma Felis concolor, jaguar Felis onca (V), ant giant eater Myrmecophaga tridactyla, red howler monkey Alouatta seniculus, deer Odocoileus sp., tapir Tapirus terrestris, collared peccary Tayassu tajacu, wild cat Felis sp. and the characteristic rodent species Thomasomys laniger. Endemic species include brocket Mazama americana-carrikeri, and the frog Atelopus carrikeri and Geobatrachus walkari. There are important populations of Andean condor Vultur gryphus, bar-winged cinclodes Cinclodes fuscus oreobates, thrush Turdus fuscater cacozelus and sabrewing Campylopterus phainopeplus. Green turtle Chelonia mydas and loggerhead turtle Caretta

caretta as well as Lepidochelis kenpii and Eretmochelys imbricana lay their eggs on the beaches of Tayrona National Park, the only area in Columbia where these reptiles are protected.

CULTURAL HERITAGE The area is of great archaeological value particularly with many artifacts of Tayrona culture.

ZONING/CONSERVATION MANAGEMENT Core area 398,000ha and buffer zone 333,250ha.

STAFF Sierra Nevada de Santa Marta: four staff comprising one professional, one technical and two general service. Tayrona National Park: 35 staff comprising one executive, two professional, one technical, 10 administrative and 21 general service.

LOCAL ADMINISTRATION Edificio Banco de la Republica, INDERENA 6 piso, Santa Marta.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research includes socio-economic organisation and forest management in the basin of the Don Diego and Don Dieguito rivers, socio-economic planning and production systems in the Galacia sector, hydrographic and zooplankton studies on the great Santa Marta swamp and archaeological research of the ruins by the Instituto Colombiano de Antropologia. Small biological station in the Gayraca area. There are animal-watching hides.

MODIFICATION OF THE NATURAL ENVIRONMENT Some modification by settlers through agriculture and cattle grazing especially in the lower areas of Tayrona National Park however control is now exercised over these areas to prevent the extension of these activities. INDERENA has acquired some land from private owners and is in the process of reconstituting the natural vegetation. There is an Indian Reserve at 3,000m where traditional land practises are carried out in equilibrium with the natural environment.

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Parc national d'Odzala

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION Total (strict reserve)

DATE ESTABLISHED First established in 1935 as a strict nature reserve. Gazetted in 1940 as a National Park of 110,000ha by Arrêté No. 2243 of 27 July. This law provided for a more precise definition of the boundaries to be established, but this has never been done. Accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Cuvette Region, M'Bomo District, north-west Congo. 30km east of the Gabon border and 120km south-west of Ouésso on the Cameroon border. 0°35'-1°05'N, 14°40'-15°05'E.

ALTITUDE 400-600m

AREA National park 126,000ha; biosphere reserve 110,000ha. Odzala is part of a continuous 284,800ha conservation area with Lekoli-Pandaka (68,200ha) and M'boko (90,000ha) reserves.

LAND TENURE Government

PHYSICAL FEATURES The area comprises an undulating plateau in the south, flattening out to the north. The park contains the blue water Lake Moba and many natural saltpans. Boundaries are defined by the Mambili River from the Odzala-Liouesso trail to the former Zalangoi post, the Zalangoi-Odzala trail, and the trail from Odzala to Liouesso to the Mambili. Mean annual rainfall is 1595mm falling all year round. Monthly rainfall varies between 30mm (July) and 210mm (October), the driest months are January and June to August.

VEGETATION About 90% of the park comprises dense evergreen forest of partly secondary origin with dense underbrush of Marantaceae species. Vegetation varies with relief and denser forest occurs in the south where the relief is greatest. Savanna occurs on the hilltops.

FAUNA Typical forest fauna includes leopard Panthera pardus (T), lion P. leo, spotted hyena Crocuta crocuta, elephant Loxodonta africana (T), dwarf buffalo Syncerus caffer nanus, great forest hog Hylochoerus meinertzhageni, bushpig Potamochoerus porcus, hippopotamus Hippopotamus amphibius, gorilla Gorilla gorilla (T), chimpanzee Pan troglodytes (T), bongo Tragelaphus euryceros, sitatunga T. spekei, duiker species including yellow-backed duiker Cephalophus sylvicultor, and several monkey species. The rare giant African swallowtail Papilio antimachus (R) has been recorded in this area.

ZONING/CONSERVATION MANAGEMENT None

STAFF One keeper (graduate of the wildlife school at Garoua in Cameroon) and four labourers stationed outside the park in the administrative centre of Mbomo. The labourers are used only to maintain the Mbomo-Camp Caravati track.

LOCAL ADMINISTRATION Direction Régional des Eaux et Forêts for Cuvette-Owando.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES No research has yet been carried out but scientific study should be made of the ecosystems. Access is possible by the

Mambili River in the north and east and by track from Mbandza to Sembé in the west. There are no scientific facilities.

LOCAL POPULATION Pygmies occupy certain areas of the park

MODIFICATION OF THE NATURAL ENVIRONMENT Poaching has been reported especially of elephant, gorilla and chimpanzee for meat and trophies. Staff are few and stationed outside the park. The park has never been developed and there is no tourism.

PRINCIPAL REFERENCE MATERIAL
No information

Reserva de la Biosfera de la Amistad

BIOGEOGRAPHICAL PROVINCE 8.16.04 (Central American)

LEGAL PROTECTION The whole area is made up of a complex of reserves with various types of legal protection, and has only recently been legally protected as a whole, by means of executive laws passed by Costa Rica's legislative assembly. Changes of land use are prohibited within the privately owned areas of the Las Tablas area but within the Indian Reserves the Indian populations have exclusive rights to the land. The Barbilla Biological Reserve has yet to be legally established.

DATE ESTABLISHED The presidents of Costa Rica and Panama jointly declared intent to establish an international park on 3 March 1979, and this was reconfirmed in Costa Rica by Presidential Decree of 4 February 1982. The Costa Rican portion was accepted as a Biosphere Reserve in 1982. Declared World Heritage Site in 1983. The International Park La Amistad is still at a proposal stage.

GEOGRAPHICAL LOCATION The park lies in the foothills and mountains of the Cordillera de Talamanca, between the mountain ranges of Las Vueltas, Cartago and Echandi on the Panamanian/Costa Rican border, and falls within Limon Puntarenas San Josen and Cartagon Provinces in Costa Rica, adjacent to the proposed park in Boscas de Toro and Chiriqui Provinces in Panama. 8°44'-10°02'N, 82°43'-83°44'W. The Panamanian park is planned to adopt the 1,800m contour as its park boundary.

ALTITUDE 50-3,820m (Cerro Chirripo, the highest point in southern Central America)

AREA The area is 500,000ha in total including 51,150ha in Chirripo National Park, 190,000ha in Cordillera de Talamanca National Park, 9,000ha in Hitoy-Cerere Biological Reserve, 10,000ha in Barbilla Biological Reserve, and 19,000ha in Las Tables Forest Protection Zone. There are also Las Tablas (19,602ha), and Telire (9,187ha), Tayni-Estrella (12,477ha), Talamanca (56,830ha), and Ujarras-Salitre-Cabagra (57,452ha) Indian Reserves. The Panamanian park is planned to cover 120,000ha.

LAND TENURE 95% of the land within the core areas is government property, but there are small scattered agricultural developments along the borders. The remaining 5% is being surveyed and will be purchased or expropriated in the near future. There are sizeable holdings of private land within the Las Tablas Protection Forest although the remainder is state-owned. Expropriation of this land is not foreseen, but legislation prohibits changes in existing land use and 90% consists of undisturbed forest. Within the Indian Reserves, the Indian population has exclusive rights to the land in perpetuity, but non-Indian settlers are gradually being relocated. The Botanical Garden is owned by the Universidad Estatal a Distancia.

PHYSICAL FEATURES The Cordillera de Talamanca is the highest and wildest non-volcanic mountain range in Central America. It was formed by the orogenic activity which created the land dividing the Pacific Ocean from the Caribbean. After a long period of marine deposition in the shallow surrounding seas up to the Middle Miocene, a period of marine volcanism began which included the intrusion of a huge granitic batholith, and the uplifting of the whole area to some 4,000m above sea level in the Plio-Quaternary orogenesis. The peneplain thus formed has been gradually eroded due to heavy rainfall, creating a rugged topography with many slopes inclined at over 60°.

During the Quaternary, glaciers carved cirque lakes and steep valleys on the slopes of the Chirripo National Park, the only area in Central America to show signs of glaciation. Most soils are poorly evolved inceptisols (leached soils). Average temperatures range from above 25°C near sea level to -8°C on the highest peaks. Mean annual precipitation varies from around 2000mm near the Caribbean coast to more than 6000mm on some high montane areas.

VEGETATION At least since the last glaciations about 25,000 years ago, tropical rain forests have covered most of the area. Of the 12 life zones of Costa Rica, at least eight occur in the park, which includes lowland tropical wet rainforest to cloud and sub-alpine paramo forests, pure oak stands, lakes of glacial origin and high altitude bogs. The latter four communities are not found elsewhere in Central America. The area also contains all 5 altitudinal zones found in the tropics. Most of the main crest lies within the Montane Rainforest life zone, characterized by mixed oak forest; a dense, low and heavily covered forest with bryophytes, ferns, bromeliads, orchids and other epiphytes. Below 2,500m the Lower Montane Rainforest life zone is encountered and the forest is generally more mixed. The Talamanca Mountains contain the largest tracts of virgin forest in Costa Rica. On high points along the ridge, at elevations above 2,900-3,100m, there are frequently stands of paramo, swamps, cold marshes and Aretostaphylos arbustoides. The paramo located on Mt. Kamuk contains the richest and most variegated vegetation (after Chirripo) in the entire Talamanca Range and is the only one in Costa Rica that shows no signs of human intervention. The whole area contains a diversity of plant genera, families or species perhaps unequalled in any other reserve of equivalent size in the world due to the convergence of the floras of North and South America, the varied climatic and edaphic factors.

FAUNA The fauna is extremely diverse, with intermigrations from both North and South America. Studies indicate that one out of the 115 species of fish, 20 out of the 250 species of reptile and amphibian, 13 out of the 215 species of mammal and 15 of the 560 species of birds are endemic to the reserve. Signs of tapirs, possibly of a species as yet unrecorded for Costa Rica, Tapirus terrestris are abundant at Cerros Utyum, Kamurk and Fabrega near the Panamanian border. All the Central American felines are found including puma Felis concolor, ocelot F. pardalis (V), jaguarundi F. yagouaroundi (I), tiger cat F. tigrina (V), and the jaguar Panthera onca (V) and also Central American tapir Tapirus bairdii (V), Central American squirrel monkey Saimiri oerstedii (E) and Geoffroy's spider monkey Ateles geoffroyi (V). Bothrops negrivisidis, a green and black high-altitude viper that has been rarely seen or collected, is present. The resplendent quetzal Pharomacrus mocinno (V) is present in the park as are many other bird species such as the bare necked umbrella bird Cephalopterus glabricollis, three wattled bellbird Procnias tricarunculata, harpy eagle Harpia harpyia (R), crested eagle Morphnus guianensis (R), solitary eagle Harpyhaliaetus solitarius and orange-breasted falcon Falco deiroleucus. It has been suggested that no other park is the world possesses so many species and such wealth of fauna. La Amistad includes nine of the 11 birds listed as 'endangered' by Costa Rica, 13 of their 16 'endangered' mammals, and all their reptiles and amphibians.

CULTURAL HERITAGE Archaeological sites are reportedly along all major water courses. Yet, an almost total lack of archaeological investigation within the area makes objective analysis of the human history difficult. However, less than fifty kilometres away, near Baru Volcano in Chiriquo Panama, pre-ceramic sites have recently been discovered dated as over 12,000 years old. Such sites are extremely rare in Central America, and yet this discovery just a short distance away indicates a possibility of more finds on Central America's earliest human inhabitants in the area. Studies on the Pacific Slope of Costa

Rica just a few kilometres from the proposed Talamanca-La Amistad World Heritage Site have revealed much about the area's pre-Colombian inhabitants. Skilfully-created elaborate zoomorphic and anthropomorphic gold ornaments and jewellery and huge symmetrical stone spheres up to two metres in diameter are among the most outstanding evidences of the cultural development of pre-Colombian man in the area over the last three thousand years. Analysis of the polychrome pottery found in digs has led to definition of two major cultural phases for the area: the Agua Buena phase lasted from 300 B.C. to 500 A.D. and the Chiriqui phase lasted from 500 A.D. until the Spanish Conquest. The recent discovery of pre-ceramic sites in the region surrounding the proposed World heritage Site presents a 10,000 year gap in the archaeological record of the area of great interest to scientists.

ZONING/CONSERVATION MANAGEMENT The core area of the Biosphere Reserve is collectively made up of Chirripo National Park, Cordillera de Talamanca National Park, Hitoy Cerere Biological Reserve and Barbilla Biological Reserve. The buffer area consists of the Indian Reserves of Talamanca, Tayni-Estrella, Telire, Chirripo, Cabagra, Salitre and Ujarras (together covering 217,441ha) as well as Las Tablas Forest Protection Zone and Las Cruces Botanical Garden (115ha). There are two levels of zoning: one at the general level of the Biosphere Reserve as a whole which is managed as one unit, and another within each specific reserve according to their different statutes. The other reserves of the overall Biosphere Reserve will be generally managed with natural zones, cultural zones, recovering zones and forest management zones. A management plan for the major part of the site is being prepared. The plan will include very detailed recommendations for the management and development of the Cordillera de Talamanca National Park and Las Tablas Forest Protection Zone. For the other reserves, more conceptual recommendations on land use and resource protection will be outlined. The preparation of this plan is being coordinated by specialists from the Wildlands and Watershed Programme of CATIE. The first stages of the planning process, resource inventories and basic information collection, were completed in 1982. Simultaneously, a planning team from Costa Rica's National Autonomous University is preparing a detailed management and development plan for Chirripo National Park. Short-term management of the protected wildlands within the proposed World Heritage Site is undertaken based on objectives, priorities and activities outlined in annual operational plans for these management units. Guard patrols and overflights assure the integrity of the resources within the natural reserves included in the site's proposed boundary.

STAFF For the various reserves, national parks etc. that make up the Biosphere Reserve, there are 45 full-time employees and 20-30 part-time, mostly engaged for protection and surveillance. There are also research workers at various times undertaking specific studies.

LOCAL ADMINISTRATION Servicio de Parques Nacionales de Costa Rica, Barrio Aranjuez, Costado Norte Hospital Calderon Guardia, Apartado 10094, San José.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Apart from a number of anthropological surveys, no comprehensive scientific studies have been conducted within the area. There are some research facilities, in particular at the Las Cruces Botanical Garden. Chirripo National Park, Cordillera de Talamanca National Park, and Las Tablas Forest Protection Zone are used for field training activities for university students.

LOCAL POPULATION At the time of the Spanish conquest, a number of Indian tribes inhabited the Talamanca range. Their numbers were decimated by conflict with Spanish settlers and imported diseases over the following centuries, and by 1940 only 6,000 Indians were left in Costa Rica along isolated river valleys in still unsettled terrain. Since then, increased public and governmental interest in their plight has led to a gradual increase in their numbers and legal recognition of their land rights. Within the area's boundaries live approximately 10,000 Indians of the Bribri, Cabecar, Brunca and Guaymi tribes. These populations represent nearly 100% of the total population of Bribris and Cabecars, and an important percentage of the remaining population of Guaymis and Bruncas left in the world. These groups have experienced varying degrees of cultural contact for over 400 years, yet have retained much of their folklore, language, customs, and subsistence agricultural, hunting and gathering lifestyle.

MODIFICATION OF THE NATURAL ENVIRONMENT There are several Indian Reservations near or contiguous with the area and man's impact in these is considerable, with about 10,000 people maintaining their traditional lifestyles with free-range grazing, hunting, fishing and use of medicinal plants. Two routes for an interoceanic pipeline which would transport crude oil from California to the US east coast markets are being considered by the Costa Rica Government. One of the routes would pass through a 4 km section of the park. A Commission of Enquiry is currently reviewing the alternatives and is due to report in the near future. The pipeline issue is a highly contentious one and is being hotly debated in Costa Rica. Oil exploration in the Talamanca reserve is a problem, as is the forest loss and soil degradation in the Ujarras, Salitre and Cabagra area. Land squatters on the Pacific side of Costa Rica are known to exist. Parts of the buffer zone have been affected by shifting cultivation and forest use, resulting in forest destruction, habitat elimination and watershed degradation. Without outside help it will not be possible for the rangers to control poaching archaeological site looters and squatters. Additional threats are posed by potential development projects proposed for areas in or near the reserve. These include construction of a cross-Talamanca highway and copper mining.

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Parc national de Taï

BIOGEOGRAPHICAL PROVINCE 3.01.01 (Guinean Rain Forest)

LEGAL PROTECTION Total. The buffer zone has the legal status of a managed fauna reserve. Taï Forest itself is under the responsibility of the Minister of Forests.

DATE ESTABLISHED Declared as a 'Forest and Wildlife Refuge' in 1926 by the French administration. National park status on 28 August 1972 by Presidential Decree 75-545. Reduced by 20,000ha ('réserve de faune du N'Zo') on 21 March 1973 by Decree 73-132. Redefined by Special Decree 77-348 of 3 June 1977, which added a 20,000ha buffer zone around the park. The area was part of a 'fôret classé' under a decree of 16 April 1926, then part of a 425,000ha 'réserve de faune' under a decree of 7 August 1956. Accepted in April 1978 as a biosphere reserve and in 1982 as a world heritage site, in November 1984 it was included in the IUCN list of eleven most threatened areas.

GEOGRAPHICAL LOCATION In south-west Ivory Coast about 200km south of Man and 100km from the coast, in the districts of Guiglo and Sassandra. Between the Cavally River (which marks the western border with Liberia) and the Sassandra River on the east. 5°15'-6°07'N, 7°25'-7°54'W.

ALTITUDE 80-623m (Mount Nienokoue)

AREA 330,000ha plus 20,000ha buffer zone; contiguous to the 'réserve de faune du N'Zo' (73,000ha)

LAND TENURE Government

PHYSICAL FEATURES The park comprises an ancient sloping granitic peneplain. This is broken by several inselbergs formed from volcanic intrusions, including the Niénkoué Hills in the south. A large zone of schists runs south-west to north-east across the park, dissected in places by tributaries of the watercourses which run parallel to it. The soils are ferralitic of generally low fertility but there are more fertile gleysoils in the south. There are two distinct climatic zones of an equatorial transitional type. Annual rainfall ranges from a mean of 1700mm in the north to 2200mm in the south, reaching a peak in June with a shorter wet season in September, followed by a marked dry season from December to February. There is only a small temperature range of 24°C-27°C due to oceanic influence and the presence of forests. The relative humidity is high (85-90%).

VEGETATION The park is one of the last remaining portion of the vast primary forest that once stretched across present-day Ghana, Ivory Coast, Liberia and Sierra Leone. There is a gradation from north to south, with the southern third of the park being the moistest and richest area, especially of leguminous trees. This humid tropical forest has a high level of endemism with over 150 species (16%) identified as endemic to the Taï region. The park contains some 1,300 species of higher plants of which 54% occur only in the Guinea zone. Vegetation is predominantly dense evergreen ombrophilous forest of a Guinean type characterised by tall trees (40-60m) with massive trunks and sometimes large buttresses or stilt roots. Large numbers of epiphytes and lianes form an important element in the lower horizons including Platycerium spp., Nephrolepis biserrata, Drymaria sp. and Asplenium africanum. Two types of forest can be recognized: the poorer soils of the north and south-east support species such as the palm Eremospatha africana, ebony Diospyros mannii, Parinari chrysophylla, Chrysophyllum perpulchrum and Chidlowia sanguinea; and

the 'Sassandrian' forest in the south-west, dominated by water-demanding species such as ebony Diospyros spp. and Mapania spp. with numerous endemic species, especially in the lower Cavally Valley and the Meno and Hana depressions near Mont Niénokoué. Gilbertiodendron spendium occurs in the swamp forest. Plants which were thought to be extinct such as Amorphophallus staudtii have been discovered in the area. Since commercial timber exploitation ceased in 1972, the forest has recovered well.

FAUNA The fauna is fairly typical of West African forests and the park contains 47 of the 54 species of large mammal known to occur in Guinean rain forest including 5 threatened species. Mammals include: mona monkey Cercopithecus mona, white-nosed monkey C. nictitans and diana monkey C. diana, black and white colobus Colobus polykomos, red colobus C. badius and green colobus C. verus (T), sooty mangabey Cercocebus torquatus, chimpanzee Pan troglodytes (T) of which there are 2000-2800 in Tai, giant pangolin Manis gigantea, tree pangolin M. tricuspis and long-tailed pangolin M. tetradactyla, golden cat Felis aurata, leopard Panthera pardus (T), elephant Loxodonta africana (T), bushpig Potamochoerus porcus, giant forest hog Hylochoerus meinertzhageni, pygmy hippopotamus Choeropsis liberiensis (T) (the only viable population remaining in the Ivory Coast), water chevrotain Hyemoschus aquaticus, bongo Tragelaphus euryceros, buffalo Syncerus caffer and an exceptional variety of forest duikers including Jentink's duiker Cephalophus jentinki (T), banded duiker or zebra antelope C. zebra, Ogilby's duiker C. ogilbyi, black duiker C. niger, bay duiker C. dorsalis, yellow-backed duiker C. sylvicultor and the royal antelope Neotragus pygmaeus. Forest rodents include Lophuromys sikapusi, Malacomys edwardsi and Graphiurus murinus. Also recorded in the park is Stochomys defua, which is characteristic of secondary forest. Over 230 bird species have been recorded, 143 typical of primary forest, including white-breasted guineafowl Agelastes meleagrides (E), Nimba flycatcher Melaenornis annamarulae (I), western wattled cuckoo-shrike Campephaga lobata (V), and yellow-throated olive greenbul Criniger olivaceus (V). More details about birds are given in Thiollay (1985). Almost 1,000 species of vertebrate have been identified.

ZONING/CONSERVATION MANAGEMENT The park is almost completely surrounded by a buffer zone, the 'Tai Zone de Protection', of about 5km width. Here, agriculture is allowed, but new plantations or any settlement are theoretically prohibited. To the north, the 'réserve de faune du N'Zo' acts as a buffer. There is a management plan for the area. Timber concessions have been withdrawn from the large companies. The park was put forward as an example for a pilot project to demonstrate the national conservation strategy being prepared under IUCN/WWF Project 3207. In the light of a major ministerial reorganization in late 1983 and the abandonment of the proposed Soubré dam scheme, further work on this project has been delayed. Taï is also the focus for IUCN/WWF Project 3052, which will provide support towards implementation of the management plan and purchase of a four-wheel drive vehicle, five motorbikes, a motorboat, radio telephones, and other essential equipment.

STAFF About 100 staff from the Ministry of Water and Forest Resources plus members of the University Institute of Tropical Ecology.

LOCAL ADMINISTRATION Ministère des Eaux et Forêts, Direction des Parcs Nationaux et Réserves Analogues, BP V 178, Abidjan.

VISITOR FACILITIES Visitor facilities are proposed in only one zone near Djiroutou which comprises mainly secondary forest resulting from previous forestry and agricultural activities.

SCIENTIFIC RESEARCH AND FACILITIES The park is the site of a MAB project on the effects of human interference within the natural forest ecosystem. This is a vast research project carried out under the auspices of the University Institute for Tropical Ecology, and there is great international scientific cooperation as exemplified by the Ivory Coast, French, Italian, German and Swiss teams presently working together on various research programmes. The site and research project have great potential for training and scientific study. ORSTOM has worked here for a number of years. There is some Ivorian research into forest termites. It is included as a project under IUCN/WWF Plants Campaign 1984-1985. In 1984 there was a Dutch team surveying the area, using an ultra-light aircraft to photograph low altitude in order to identify dying trees for use as timber. From 1979 to 1985, Swiss researchers were studying chimpanzees. There is an ecological station in Andrenisrou basin in the core zone and the Federal German team base at Fedfo camp in the buffer zone. There is also a MAB station 18km south-east of Taï village, which consists of several prefabricated houses, a communal kitchen, two well-equipped laboratories, and an electric generator. It is controlled and financed nationally and managed by two-three Ivorian personnel.

LOCAL POPULATION There are two main groups of inhabitants in the area, the rural Bakoué and Kroumen on the forest edge with only marginal impact on the forest and the Baoule who are responsible for most of the forest destruction.

MODIFICATION OF THE NATURAL ENVIRONMENT In the northern part, 70,000ha are temporarily ceded for exploitation. There are some cultivation plots in the buffer zone. Timber exploitation remains a potential threat both in the buffer zone and in the park, particularly in the north and along the road bordering the southern boundary where extensive felling is taking place. Theoretically, this is a 'fôret classé', but vast blocks are being clear-felled with an enormous waste of timber. Crops such as cocoa, coffee, maize, coco yam, sweet potato and okra are then planted, with cash crops taking up more and more land. Since independence, this region has become the principal producer of rough timber. A perimeter road designed to define the boundaries and make protection more effective has had the reverse effect, opening up significant portions of the park to timber contractors, shifting cultivators and poachers. In 1977, there were said to be many elephants, conspicuous even in the buffer zone. Now only a few remain, probably due to a combination of disturbance and poaching. There is insufficient staff to deal with the extensive poaching that takes place. The park has also been severely affected by gold panning activities in the central region. The Soubré dam scheme has now been abandoned. This would not only have affected people who would have been uprooted but would also have affected the local economy and the environment, and Taï would have suffered by the displacement and influx of people to which it would give rise. There is a lack of means to carry out effective management, and research has been more theoretical than management-orientated.

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Parc national de la Comoé

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Total

DATE ESTABLISHED 8 February 1968 by Decree No. 68-91. Originally protected as the 'réserve de faune de Bouna-Komoé' by Decree 1605 of 4 March 1953 though rudimentary protection existed since 1926. Accepted as a Biosphere Reserve and a World Heritage Site in 1983.

GEOGRAPHICAL LOCATION Extending from 35km south-west of Bouna, in the north-east préfectures of Bouna and Ferkessedougou, westwards across the Comoé River to the vicinity of Kong. 600km from Abidjan. 8°05'-9°06'N, 3°01'-4°04'W.

ALTITUDE 119-658m (Mont Yévelé)

AREA 1,150,000ha

LAND TENURE Government

PHYSICAL FEATURES The park comprises an interfluvial peneplain of schist and granite between the Comoé and Volta rivers, with mean altitude of 250 to 300m and a series of ridges and granite inselbergs rising to 600m. The River Comoé and its tributaries form the principal drainage and the Comoé runs through the park for 230km. Watercourses also drain to the Volta in the east. Permanent and semi-permanent water occurs in many places. The soils are infertile and unsuitable for cultivation. There is a Sudan-type humid tropical transitional climate with mean annual rainfall of 1200mm and a single dry season of six months in the south and eight months in the north. Mean annual temperature is 26°C.

VEGETATION The park contains a remarkable variey of habitats and plant associations found, more often, further south, including savanna, forests and riparian grasslands. It provides an outstanding example of an area of transitional habitat from forest to savanna. Open forest and savanna woodland characteristic of the Sudano-Guinean zone, occupies about 90% of the area, and gallery forest and dense dry forest, about 10%. All types of savanna occur. The forest is composed of many leguminous trees including Burkea africana,

Detarium micranthum, Afzelia africana, Daniellia oliveri, and Isoberlinia doka. The savanna grasslands consist mainly of Panicum, Ctenium, Andropogon, Elionurus and Cymbopogon species varied by some Bauhinia spp., Combretum spp. and Gardenia spp. thicket. The gallery forests are dominated by Cynometra vogelii; the patches of dense dry forest by Isoberlinia doka, Anogeissus leiocarpus, Cola cordifolia, Antiaris africana, Chlorophora excelsa, and the edible 'akee' Blighia unijugata; and the flood plains by Hyparrhenia rufa. Other forest species recorded include: Parkia biglobosa, Pterocarpus erinaceus, Combretum, Terminalia, including T. avicennioides, shea nut Butyrospermum parkii and Uapaca somon, Lophira lanceolata, Protea elliotii, Burkea africana, Borassus aethiopum, Mitragyna inermis and Entada abyssinica, a grassy ground cover of Andropogon spp.. Areas of specialised vegetation occur on the rocky inselbergs and in aquatic habitats. A species list for the park can be found with the biosphere reserve nomination form submitted to Unesco.

FAUNA Comoé forms the northerly limit for some species including yellow-backed duiker Cephalophus sylvicultor and bongo Tragelaphus euryceros. There are a large number of mammal species with 11 species of monkey including: anubis baboon Papio anubis, green monkey Cercopithecus aethiops, diana monkey Cercopithecus diana, mona monkey C. mona, lesser white-nosed monkey C. petaurista, white collared mangabey Cercocebus torquatus lunulatus, black and white colobus Colobus polykomos and chimpanzee Pan troglodytes (T); 17 species of carnivore including lion Panthera leo and leopard P. pardus (T); giant pangolin Manis gigantea, aardvark Orycteropus afer, and rock hyrax Procavia capensis; and 21 species of artiodactyl including bushpig Potamochoerus porcus, warthog Phacochoerus aethiopicus, hippopotamus Hippopotamus amphibius, elephant Loxodonta africana (T), bushbuck Tragelaphus scriptus, sitatunga T. spekei, buffalo Syncerus caffer aequinoctialis, red-flanked duiker Cephalophus rufilatus, waterbuck Kobus ellipsiprymnus, kob K. kob, roan antelope Hippotragus equinus and oribi Ourebia ourebi. Birds include 10 species of herons such as grey heron Ardea cinerea, goliath heron A. goliath, yellow-billed egret Egretta intermedia, ducks (Anatidae), raptors (Accipitridae), plovers and francolins (Phasianidae), hammerkop Scopus umbretta, black winged stilt Himantopus himantopus, four of the six West African stork species, and five of the six West African vulture species. Reptiles include all three species of African crocodile, slender-snouted Crocodylus cataphractus (I)(9%), Nile C. niloticus (V)(90%), and dwarf Osteolaemus tetraspis (I)(1%). A species list for the park can be found with the biosphere reserve nomination submitted to Unesco.

ZONING/CONSERVATION MANAGEMENT There is a strict reserve zone where tourism is prohibited. The development of a buffer zone encompassing a contiguous game reserve is currently being studied. There are two tourist zones within the park for short and long-term visits. A management plan has been produced. 17 patrol posts at 20-30km intervals are planned around the park boundary.

STAFF Eighty-two employees including fulltime staff of one park warden, seven assistant wardens, 26 guards and 34 watchmen.

LOCAL ADMINISTRATION Chef d'Inspection, Conservateur du Parc National de la Comoé, Bouna.

VISITOR FACILITIES The park is only open during the dry season (November to April) when the 500km of tracks are accessible. There are hotels at Kak pin, Ganse and Kafola (safari lodge), which are popular but expensive. Peak periods for visitors from the Ivory Coast are Christmas and Easter.

SCIENTIFIC RESEARCH AND FACILITIES Research under the MAB programme including work on ungulates was planned to start in 1983. A complete inventory of the natural resources of the park was undertaken in 1974 with further studies financed by bilateral aid in 1977 and 1980. Work on climate, vegetation, soils, hydrology, plant and animal populations and pollution has been completed. A scientific research station is due to be built in 1985. Limited accommodation is available for scientists.

MODIFICATION OF THE NATURAL ENVIRONMENT Problems include poaching particularly of elephant, roan and waterbuck, though the threat is less serious since implementation of a vigorous anti-poaching campaign in 1974. There is some agriculture, but the area has been little modified, mainly due to the presence of the black fly Simulium sp., which causes river blindness in man, and which has discouraged agricultural encroachments or settlements. Uncontrolled burning and grazing of cattle from the south still occurs.

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Sierra del Rosario

BIOGEOGRAPHICAL PROVINCE 8.39.13 (Cuban)

LEGAL PROTECTION Protected under Law No. 33/81 signed in Habana 12 February 1981.

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1984; original reserve was established in 1981.

GEOGRAPHICAL LOCATION Situated in the eastern part of the Sierra del Rosario in the Guaniguanico hills, approximately 50km from Habana. Most of the reserve falls within the municipality of Candelaria in the province of Pinar del Rio but part of the area extends into the province of Habana. 22°47'-22°54'N, 82°52'-83°00'W.

ALTITUDE 50-550m

AREA 10,000ha

PHYSICAL FEATURES The reserve falls on the eastern flank of the River del Rio Anticline, which forms a part of the Antillean Geosincline. Stratigraphic units vary between the Jurassic and Paleogene periods and a geological mosaic is formed by cast processes which create characteristic localised reliefs in areas of serpentine rocks. The San Juan river runs through the reserve in addition to numerous streams and the terrain itself is hilly.

VEGETATION The reserve is composed of various types of vegetal associations, which are clearly affiliated with the Neotropical Hemisphere, Central and South America and the Caribbean. Although submontane evergreen tropical forest predominates, there are also areas of humid evergreen tropical forest with a high degree of endemism, and thorny matorral xeromorphic and herbaceous communities. Threatened plant species found in the reserve include Pachyanthus tetramerus, an endemic of Pinar del Rio, Ouratea laurifolia, Derypetes triplinervia and Cynometra cubensis, also endemic to Pinar del Rio.

FAUNA The reserve is characterised by an abundance of birds, reptiles and amphibians and by a scarcity of mammals as is typical of Cuba. The smallest frog in the world Smithilus limbatus is found here as well as a wide variety of invertebrates including the threatened mollusc Lygus sp.. The presence of Atta insularis is suggested by defoliation activity and traces in wood decomposition. Among the bird species observed in the reserve are Priotelus termurus, Xiphidiocarpus percussus, Teretistris fernandinae, Dives atroviolacea, Tiaris canora, Glaucidium siju and Colaptes fernandinae, all Cuban endemics.

ZONING/CONSERVATION MANAGEMENT A nuclear zone of 100ha is situated in the highest parts of the reserve where the vegetation and habitat is the least disturbed and best represented and the topography helps to maintain a certain degree of isolation. A buffer zone of 1,000ha is found lower down where tree-felling and hunting are forbidden by law. There are plans for controlled re-afforestation.

STAFF Total of 134. Four permanent technicians responsible for monitoring the reserve. In addition there are forest guides.

LOCAL ADMINISTRATION Instituto de Botanica ACC, Calzada del Cerro 1257, Gaveta Postal 20006, Ciudad Habana.

VISITOR FACILITIES Easy access from Habana via paved roads. There is a tourist centre plus picnic areas and a café.

SCIENTIFIC RESEARCH AND FACILITIES Scientific studies have been undertaken since 1968 including work in practical forestry, vegetation, productivity, nutrient cycles, decomposition, regeneration, soil fauna, climatology and taxonomy.

LOCAL POPULATION There are two rural communities, one of 100 families, one of 150. In addition there are families dispersed throughout the agricultural areas of the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT No information

PRINCIPAL REFERENCE MATERIAL
No information

Krivoklatsko Protected Landscape Area

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION The whole area is protected as a Protected Landscape Area created in 1978. Additionally there are 16 areas protected a national and local nature reserves and three as protected natural monuments.

DATE ESTABLISHED Declared a biosphere reserve; in January 1977 and as a protected landscape area under Decree No. 21.972/78, in November 1978.

GEOGRAPHICAL LOCATION The reserve is situated in the western part of the Middle Bohemian range in the Czech Socialist Republic in the districts of Beroun, Kladno, Rakovnik, Plazen-Sever and Rokycany. It is centred on the valley of the Berounka river and lies only 16km west of Prague and 23km north-east of Plzen. The Cesky Kras Landscape Protected Area is 7km to the east along the Berounka valley. 50°00'N, 13°52'E.

ALTITUDE 223-616m

AREA 62,792ha

LAND TENURE State and private. Forests, waters and most of the arable land are owned by the state; limited areas of fields, gardens and orchards are in private ownership.

PHYSICAL FEATURES The highly meandering river Berounka divides the Krivoklat Highlands into the northern hills of Lany and the southern Zbiroh highlands. It is remarkable for its diversity of relief, with deeply cut valleys and numerous lateral gorges and hollows. The Krivoklat area is built up of folded Upper Proterozoic and Lower Palaeozoic complexes of the Barrandian basin. The central part is formed of shales, lydites and spilites flanked in the north-west by Cambrian marine deposits and terrestrial volcanics, and in the south-east by Ordovician sediments and submarine effusive rocks. Near Skryje, the famous localities of Middle Cambrian fauna (renowned for the numerous development forms of trilobites) are situated. Important palaeontological localities of Ordovician age are spread within the south-east marginal zone. The mean annual precipitation is 500-550mm; the mean annual temperature is 7-8°C.

VEGETATION The area is largely covered by natural, mixed forest (64%) deciduous. Forests of oak Quercus sp., hornbeam Carpinus betulus, beech Fagus sylvatica, maple Acer sp. and lime Tilia cordata, Sorbus terminalis, S. aria, are mixed with Abies abba and grade into stands of yew Taxus baccata and juniper Juniperus communis on steep slopes, over an understorey of Cornus mas and Cotoncaster integrrima. Rare and interesting plants in the area include: Adenophora liliifolia, Daphne mezerium, Adonis vernalis, Allium ursinum, Cephalanthera rubra, Cypripedium calceolus, Dianthus superbus, Lunaria rediviva, Ophrys mucifere, Orchis purpurea, also Sesleria calcarea, Saxifraga aizoon, Anthericum liliago, Orthantha lutea, Woodsia ilvensis and Pra badensis.

FAUNA Mammals include otter Lutra lutra, red deer Cervus elaphus, fallow deer Dama dama, roe deer Capreolus capreolus and wild boar Sus scrofa. Uncommon bird species present are the eagle owl Bubo bubo, black stork Ciconia nigra and wallcreeper Tichodroma muraria. Amphibians and reptiles are represented by the alpine newt Triturus alpestris, warty newt T. cristatus, smooth newt T. vulgaris, fire salamander Salamandra salamandra, green lizard Lacerta viridis and viviparous lizard Lacerta vivipara. There are also two species of

crayfish. Invertebrate fauna is diverse with the endemic Laciniaria nitidosa, and butterfiles Parnassius apollo, P. mnemosyne and the long horn beetle Rosalia alpina.

CULTURAL HERITAGE There are a number of castles present and many villages remain in the traditional architectural style which adds to the landscape value of the area.

ZONING/CONSERVATION MANAGEMENT The Protected Landscape Area includes 16 nature reserves and three natural monuments ranging in size from 1ha to 430ha the largest being Tyrov Nature Reserve covering 419ha. The reserve is characterized by a pattern of small core areas surrounded by zones of variously managed landscape, in which agriculture and forestry is not restricted. In 1980 a School Nature Trail Krivoklat was opened in the core of the area, with 25 interpretive stations.

STAFF Staff of four

LOCAL ADMINISTRATION Centre for Monument and Nature Conservancy, (Krajske streidko pamatkove pece a ochrony prirody) Praha 5, Zborovska 11.

VISITOR FACILITIES The reserve being so close to large urban centres such as Prague and Plzen acts as a recreation area for a large number of tourists. Various sporting activities take place here.

SCIENTIFIC RESEARCH AND FACILITIES Within the reserve there are several designated forest-research areas. Research projects are mainly concerned with the structure and functioning of various ecosystems and is coordinated within the framework of the State Plan of Technical Development conducted by the Central Geological Institute. During 1981-1985 the State Institute for Protection of Monuments and Nature Conservation conducted research on the conservation of threatened and rare plants and biogenetic research. Botanic, zoologic, malacozoologic and geologic research are carried out by the Czech Academy of Sciences and the National Museum. A complex investigation into watershed energy transfer and the biogeochemical balance in the reserve has been in progress in four watershed areas.

LOCAL POPULATION There is a sparse population due to the relief of the terrain, the dense forest cover, and the ownership relations. Population density is 40 persons per square kilometre.

MODIFICATION OF THE NATURAL ENVIRONMENT The forest area have in ancient times been owned by Czech kings and served as a hunting ground and source of timber. In the area there is only one small industrial enterprise which does not influence the natural environment by its activities.

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Slovensky Kras Protected Landscape Area

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION The legal status of the region is derived from the law on Nature Protection no. 1/1955 Zb.SNR/Slovak National Council. By virtue of this law, the Slovak Karst was declared a protected landscape area by decree of the Ministry of Culture of the Slovak Socialist Republic No. 110 dated August 31 1973.

DATE ESTABLISHED Established as a Protected Landscape Area in 1973 and approved as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION In the south-east of the Slovak Socialist Republic, some 20km south-west of Kosioe stretching 50km between the River Bodva in the east, the River Muran in the west, the Rudo Horic Uplands in the north and the Hungarian border (Aggtelek National Park) in the south. 48°35'N, 20°40'E.

ALTITUDE 200-925m (at Matesova Skala)

AREA The biosphere reserve is 36,165ha, the same size as the protected landscape area.

LAND TENURE The Central Management (State Forest Service) administers 75% of the territory, the remaining 25% being under local management (Agricultural Cooperatives, local National Councils, private owners). Agricultural land covers 7,203ha and forests 27,542ha.

PHYSICAL FEATURES The Slovak Karst is the largest and most outstanding and characteristic karst area in Czechoslovakia, consisting of a system of plateaux, separated by deep canyons of the Slana and Stitnik rivers, and the gorges of Zadiel, Hajske and Miglinec. The Slovak karst is composed of two groups of rock formations of different geomorphology. The subsoil comprises lower Triassic impermeable, weakly resistant, argillaceous and marly slates, variegated grit and sandstone, and marly limestones. In the overlay there are massive layers of predominantly middle Triassic, but also upper Triassic,

extremely resistant limestones and dolomites. There are numerous surface and underground karst phenomena, developed in a classic shape over an extensive territory. Some underground passages connect with systems originating in Hungary. The mean temperature in the lowest altitude, is below -3°C in January and above 19°C in July; these values drop with increasing altitude so that the corresponding figures for the highest altitude sites are about -7°C and 14°C respectively. The annual rainfall amounts to about 620mm in the lowest, and about 1000mm in the highest parts of the tablelands. Depending on elevation, snow cover persists here between 60 and 139 days.

VEGETATION The forests are largely hornbeam Carpinus betula, oak Quercus petraeae and beech Fagus sylvatica but include such species as Fraxinus ornus and Acer tataricum especially on the areas occupied by forest-steppes. The flora of the area is among the most interesting of the Western Carpathians and has been extensively documented. The wealth and colourfulness of plant life can be seen from some 100 publications describing the flora of the Slovak Karst. Among the more interesting species are: Onosma tornensis, Sesleria heufleriana, Crataegus domicensis, Sorbus austriaca spp. hazslinszkiana, and Dianthus lumnitzeri var. pseudopraecox (endemics). In Slovakia, this is the only place where Ajuga laxmanii, Erythronium dens-canis, Carex brevicollis, Astragalus vesicarius, Cytisus procumbens, Gasparinia peucedanoides and Euphrasia pectinata are present at the northernmost limit of their distribution. The limestone underlay and the warm, moderately dry climate, provide habitats for over 900 species of vascular plants, making this territory among the richest taxonomically in Central Europe. Even though the original forest vegetation has been considerably altered through man's intervention, there are still a whole series of oak associations and floristic elements with unique features, considered to be indicative of the development of a Matran-Carpathian vegetation. Also of interest are the marshes and meadows, association of pseudo-rocky steppes and rocky overhangs, cliffs, chasms and ravines. The inversion of vegetation zones in deep crevasses and ravines is so well developed as to have no parallel within the Carpathian arch.

FAUNA The fauna is characteristic of steppe or forest-steppe habitat with montane elements preserved in the damp and cool valleys. Of particular scientific interest are the fauna of caves and subterranean karst waters. Karst forms of beetles and insects are abundantly represented and mention should be made of the occurrence of the endemic snail Sadleriana pannonica. Among reptiles, lizards are the most numerous. The rocky steppes and forest steppes are the haunt of rock bunting Emberiza cia, the northernmost locality in Europe. In addition, rock thrush Monticola saxatilis, peregrine falcon Falco peregrinus, saker F. cherrug, short-toed eagle Circaetus gallicus, lesser spotted eagle Aquila pomarina and others are present, while innumerable colonies of bats haunt the caves. The area marks the westernmost disribution for striped field mouse Apodemus agrarius whilst Miller's water shrew Neomys anomalus is found here in large numbers. Also present are red deer Cervus elaphus, roe deer Capreolus capreolus and introduced species such as Ovis sp., and wild boar Sus scrofa.

ZONING/CONSERVATION MANAGEMENT The protected landscape area consists of one large, very irregularly shaped unit separated from a smaller unit to the west by the valley of the river Slana which is itself separated from a yet smaller area to the west separated by the valley of the river Stitnik. The protected landscape area is surrounded on all sides (except for the boundary where it forms the border with Hungary) by a buffer zone consists of 38,334ha. The total area is 74,499ha. The area includes twelve national nature reserves one protected forest reserve, and nine protected monuments. The aim is to protect and improve the natural conditions and nature resources of the territory; to

ensure coordination of its economic exploitation in conformity with measures for the protection of the natural landscape in view of its multiple use as a cultural, scientific, economic and health-recreational reserve.

STAFF Five persons are assigned to the protection of the area and 16 scientific-research workers.

LOCAL ADMINISTRATION The Slovak Institute for the conservation of the Monuments and Nature Conservation of the Protected Region of Slovak Karst, Slovensky Kras, 049 51 Brzotin, Biely Kastiel', okr. Roznava, Czechoslovakia. Scientific Research Centre, Department of Geobotanics, Natural Science Faculty, Comenius University, 80000 Bratislkava, Moskovska 2/a, Czechoslovakia.

VISITOR FACILITIES Out of the great number of caves, four may be visited by the public but general access to the reserve requires the authority of the Management of the Protected Regions of the Slovak Karst, with headquarters at Brzotin. An international nature trail has been created which connects the Slovak Karst with Aggtelek National Park in Hungary.

SCIENTIFIC RESEARCH AND FACILITIES In addition to earlier research conducted on flora, fauna, speleology, geomorphology and geology of the territory, a complex floristic and phytocenologic survey was undertaken in 1970 on a selected part of the Slovak Karst, the Silice Tableland, by the Department of Geobotanics of the Natural Science Faculty, Comenius University, in Bratislava. The flora of the site has been recorded in over 100 publications. As a first stage, as the basis for a map of the climax vegetation. For the period 1976-1980, approval was given for a complete survey of the entire Slovak Karst within the state plan of research for the Comenius University, titled 'Study of Plants and their evolution in the Carpathian Region' as well as research conducted by the Central Office for State Nature Conservation in the programme 'Protection of Nature and its Components'. The main objective of the survey will be to determine the types of vegetation and their syntaxonomic evaluation, along with mapping of all contemporary vegetation. In the future, research on the effects of man's interactions with various ecosystems within the region has to be reinforced. Research permits are required from the Management of the Protected Region of the Slovak Karst, with headquarters at Brzotin.

MODIFICATION OF THE NATURAL ENVIRONMENT In the past, much of the region was affected by deforestation, which together with grazing resulted in soil erosion on steep terrain; elsewhere it promoted the appearance of steppes and of xerothermic vegetation. Despite this, the majority of the protected area is still covered by natural vegetation. However, present threats change from traditional agriculture to large scale production of cereals; the accompanying increased use of fertilizers and pesticides that introduce considerable quantities of chemical compounds into the underground cave waters; the motorized tourism causing air pollution in the underground river courses and chasms and pollutant emission from industrial sources.

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Trebon Basin Protected Landscape Area

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION The whole site is protected as a Protected Landscape Area created in 1979. Additionally there are nine areas protected as national nature reserves.

DATE ESTABLISHED Declared a Biosphere Reserve in January 1977 and as a Protected Landscape Area by Decree No 22.737/79 of the Minister of Culture in November 1979, coming into force in March 1980.

GEOGRAPHICAL LOCATION The reserve is situated in the Czech Socialist Republic in southern Bohemia, centred on the town of Trebon, 100km south of Prague, 13km due east of Ceske Budcjovice and extending to the Czechoslovak-Austrian border. 49°00'N, 14°50'E.

ALTITUDE 407-613m (Homolka Hill in the south-east)

AREA 70,000ha

LAND TENURE State and private (forests, fishponds and most of the arable land is state owned; a limited area of fields, gardens and orchards are private)

PHYSICAL FEATURES The local topography is flattish or slightly undulating with a lack of sharp relief although the eastern part lies in the hilly region of southern Bohemia. Underlying rocks are primarily Cretaceous and Tertiary sedimentary, with some cristallines present in the eastern part of the reserve at the Nova Bystrice Hills. Soils are composed of sands, clays, gravels and peats, and the site is characterised by a complex of rivers, streams and channels together with fishponds, although thre are also small areas with sand dune systems. The climate is marked by relatively long periods of clear weather with an annual mean air temperature of 7.8°C and annual mean precipitation of 627mm.

VEGETATION A large part of the area is covered in forests, mainly Scots pine Pinus silvestris, silver fir Abies alba and Norway spruce Picea abies. Smaller remnants of broadleaved forests are found in river flood-plains with Quercus robur, Acer spp., Tilia spp. and Ulmus spp. Fen woodlands occur in swampy areas with Alnus glutinosa as the characteristic species. Peat and moorland communities include Pinus rotundata, Pinus silvestris ssp. uncinata and numerous shrubs. Wet meadows, xerothermic grasslands and sandy habitats complete the ecological diversity within the reserve. Among rare and

protected plants are: Caltha palustris, Daphne cneorum, Dianthus superous, Drosera anglica, D. intermedia, D. obovata, D. rotundifolia, Dryopteris cristata, D. thalypteris, Gentianella bohemica, Ledum palustre, Lilium martagon, Liparis loeseli, Malaxis paludosa, Nuphar luteum, N. pumilum, Nymphaea alba, N. candida, Orchis morio, Pulsatilla vernalis and Trapa natans.

FAUNA The reserve is particularly important for birds with nearly 200 species recorded including 150 breeding species such as greylag goose Anser anser, goldeneye Bucephala clangula, mute swan Cygnus olor, white stork Ciconia ciconia, marsh harrier Circus aeruginosus, grey heron Ardea cinerea (the largest colony in Czechoslovakia with 500 nests), purple heron A. purpurea, cormorant (small colony) Phalacrocorax carbo, red crested pochard Netta rufina, white tailed sea eagle Haliaetus albicilla, kingfisher Alcedo atthis, bittern Botaurus stelaris, Savi's warbler Locustella luscinioides, penduline tit Remiz pendulinus, and numbers of crake species, duck, geese and warblers. Rare mammals and amphibians include otter Lutra lutra, elk Alces alces tree frog Hyla arborea, common spadefoot Pelobates fuscus, natterjack toad Bufo calamita, viviparous lizard Lacerta vivipara and grass snake Natrix natrix. There are also numerous species of insects peculiar to peat bogs, wetlands and sandy habitats, rare boreal and tundra species and some endemic species.

CULTURAL HERITAGE Since the 14th century the area has been gradually transformed by man, resulting in a landscape comprising all kinds of natural, semi-natural and artificial ecosystems as well as numerous monuments, old villages, churches, and castles.

ZONING/CONSERVATION MANAGEMENT The Protected Landscape Area includes nine nature reserves which are strictly protected. These include bird reserves at the Maly and Velky Tisy fishponds, one of the largest forest and reserves in the country at Stara Reka and two extensive peat bogs - Cervene Blato and Zofinka. The aim of the reserve is to preserve the landscape for national use and recreation. The reserve is characterized by a pattern of small core areas surrounded by zones of variously managed landscape. Woodlands cover 35,900ha, arable land and meadwos 25,300ha and water areas 8,000ha in some 500 fishponds. In 1980 a detailed project was completed entitled 'Ecological Optimation of the Management in the Trebon Landscape and Biosphere Reserve' a part of which was devoted to environmental education.

STAFF Between three and five officers work with the authorities of the Trebon Basin Reserve; approximately 30 officers perform research in the resident scientific institutions. It is not known how many specifically administer to the reserve.

LOCAL ADMINISTRATION Sprava CHKO Trebonsk, 37901 Trebon, Coordinator Centre for Monument and Nature Conservancy, (Krajske stredisko pamatkove pece a ochrony prirody) Ceske Budejovice, Zizkovo Square, CSSR.

VISITOR FACILTIIES Parts of the Cervene Blato Nature Reserve is open to the public along a nature trail starting at Jirikovo Udoli near Slamanovice.

SCIENTIFIC RESEARCH AND FACILITIES Research projects refer to the structure and functioning of various ecosystems, and to interrelationships between ecosystems and agriculture. The area was used for the International Biological Programme projects, and is also considered for research within the framework of MAB projects Nos. 2 and 8. Several permanent laboratories and temporary field stations are situated in the Trebon (since 1953), namely those of the Czechoslovak Academy of Sciences (Dept. of Botany, Dept. of Hydrobotany, Dept. of Microbiology, Dept. of Landscape Ecology, Dept. of

Parasitology and Dept. of Entomology) and the National Museum. The Hydrobotany Department employs 31 permanent researchers and hosted the 2nd INTECOL/SCOPE International Wetlands Conference in 1984. Four working groups coordinate an extensive research programme covering algal ecology, vascular plant communities, wetland ecology and their synecology.

LOCAL POPULATION The area is much frequented by tourists, and serves as a centre for various sports and other types of recreation.

MODIFICATION OF THE NATURAL ENVIRONMENT The region around Trebon represents a landscape modified since the fourteenth century by man's activities. The water regime has been greatly altered and forests and agricultural land has been drained but has resulted in the establishment of a large scale fisheries operation and fish ponds which have created near-natural conditions. The most valuable portions of the reserve are protected in nine nature reserves. New proposals have been presented to regional and national bodies for further conservation designations. The main objective of the reserve is to support an ecologically sound management using scientific landuse methods, for the coexistence of agriculture, forestry, fisheries and wildlife. There is exploiting of gravel and forestry and agriculture practices are not overtly controlled. Other problems include aerial spraying of pesticides, possible over-exploitation of peat, extraction of sand with resultant open pits and mineral extraction affects the ground water level.

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Palava Protected Landscape Area

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION The Protected Landscape Area was established by a decree of the Czech Ministry of Culture (No. 5790/76 on 19 March 1976) under the legislation No. 40/1956 on the State Protection of Nature. Strict nature reserves are governed by decrees confering strict protection. The Act aims to preserve and enhance the quality of the landscape and to control the development of this area.

DATE ESTABLISHED The Protected landscape Area designation was applied in 1976. The area was approved as a biosphere reserve in 1986.

GEOGRAPHICAL LOCATION The area is situated 35km south of Brno in southern Moravia and adjoins the Austrian border. It is 11km from east to west and 12km north to south and includes, amongst others, the town of Mikalov.

ALTITUDE 163-550m

AREA Total area of 8,017ha, which includes 11 strict nature reserves totalling 672ha.

LAND TENURE Mostly State ownership, with some cooperative lands and partially private. The forests are totally state owned; the agricultural areas are both state and cooperative owned whilst small areas such as orchards, vineyards and gardens are private.

PHYSICAL FEATURES The area includes the westernmost extent of the White Carpathian range, the Mikulov Highlands where they adjoin the Dyje river valley. The area has been formed by periglacial and karst processes resulting in limestone outcrops (Pavlovske vrchy) in an otherwise rolling landscape of lowlands and hills. There are thick loess and colluvial deposits some of which are of European stratigraphic importance, present in the flood plain of the Dyje River. Mean annual temperature of 9°C and mean annual percipitation of 524mm.

VEGETATION The oak Quercus petraea and hornbeam Carpinus betulus forests grade into forest steppe and steppe with smaller areas of saline steppe which support rare halophytes such as Crypsis aculeata and Samolus valerandii. The steppe and forest steppe habitats support pontic-pannonian and submediterranean communities present here at their northern and western limits, for example, such species as Salvia aethiopis, and Orlaya grandifolia. On the southern slopes there is the appearance of Quercus petraea and Quercus pubescens woodland with associations of lime Tilia platyphyllos, sycamore Acer pseudoplatanus and Cornus mas and Prunus mahaleb on scree slopes. The Dyje river flood plain remnants of alluvial forest of Q. robur and Fraxinus angustifolia with an understorey of Leucojum aestivum some 56% of the reserve is agricultural land and 33% is forest which is used mainly as game parks. Very important steppe plant communities include Poa badensis, Festuca glauca, Sesleria calcarca, Alsine setacoa, Festuca vallesiaca and Ranunculus illyrious. Other species include Funana procumbens, Iris pumila, Iris arenaris, Verbascum pheoniceun, Dianthus plumarius, Biscutella laevigata and Saxifraga aizoon.

FAUNA There are no mammals of note (a number of deer species are kept in the game parks) few birds which, however, include eagle owl Bubo bubo and rock thrush Monticola saxatilis and grey lag geese Anser anser but particularly rich insect fauna which supports a number of ponto mediterranean, pontic and sarmatic species are at their northern most boundary here. These include Saga pedo, Mantis religiara, Bombus fragrans, Zerynthia hypsypile, Anthaxia hungarica and Marumba quercus. A number of interesting molluscs are also present including Chondrula tridens and Helicopsis striata.

CULTURAL HERITAGE Archaeological evidence suggest settlements in the area since 25,000 years ago. There are remains of the Great Moravian Slavonic hill-forts present.

ZONING/CONSERVATION MANAGEMENT The biosphre reserve covers 8,071ha and is designated as a Protected Landscape. Within this there are 11 strict nature reserves defined as core areas which cover 672ha. The remaining buffer area contains numerous settlements and extensive agricultural lands. The steppes and forest-steppes are not suited for agriculture and are left in a natural state while most of the forests have been coppiced in the past. Overall about half the area is used for extensive agriculture and another third as game parks. The territorial management plan governs the principles of reserve management and proposes the demarcation of core areas and bio-corridors linking the cores. The plan proposes the optimal economic use of land which does not endanger the natural resources. A separate management plan has been prepared for a system of reserves Devin-Souteska-Kotel in the buffer zone which deals with the location of farmlands and the use of traditional agricultural practises. Within the strict nature reserves all damaging activities are prohibited and they are separated from the intensively agricultural landscapes by buffer zones.

STAFF Of the staff of four, two are university trained

LOCAL ADMINISTRATION Sprava Chranene krajinne oblasti Palava, namesti J. Fucika 15, 69201 Mikulov.

VISITOR FACILITIES The area is commonly used for tourism and recreation at a local level.

SCIENTIFIC RESEARCH AND FACILITIES Research in this area has been carried out since before 1900 and continues to date in the form of several long-term studies organized principally by the Czechoslovak Academy of Sciences and several universities. The Forest Ecology Institute of Brno Agricultural College has researched the riverine forests within the framework of MAB Project 2. The Institute of Geography of the Academy of Sciences has researched landscape structural changes using remote sensing by aerial photographs taken from a model airplane. There are several field and research stations with continuous monitoring of climate, vegetation, soils, hydrology, and flora and fauna populations. Accommodation for researchers is available at Lednicky luh, Lednicke rybniky, Lednice, Drnholec, and Nove Mlyny with the administrative building in Mikulov capable of putting up 25 persons. there is an extensive environmental education programme designed around the requirements of the local population and their attitudes to nature conservation consisting of adult education, lectures and excursions. The most recent of these has been a public opinion poll on the atitudes of the resident population to the protected landscape area, which revealed amongst other things that only 63% realized they lived in a protected landscape area and that 84% were hostile to the idea of tourism in the area. Through a series of local and District National Committees the resident population via its respresentative, takes an active part in the short and long term. Management of the strict reserves and local inhabitants have become voluntary wardens. the reserves are also utilized in field courses for students of J.E. Purkyne University and Brno Agricultural College.

LOCAL POPULATION In total there are ten municipalities, both rural and urban with a total population in 1977 of 12,370 which has subsequently increased. Half the area is agricultural and there are numerous settlements, the largest being the town of Mikulov with a population of 13,000.

MODIFICATION OF THE NATURAL ENVIRONMENT The forests were once coppiced and are now largely used as game parks and there is an unspecified level of tourism use. At Musov, on the road between Mikulov and Pohorelice,

immediately north of the reserve, the once extensive riverine forest had by 1984 been reduced by two-thirds of its area and replaced by shallow basins which retain water for irrigation. Some pollution has occurred.

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Northeast Greenland National Park

BIOGEOGRAPHICAL PROVINCE 1.17.09 (Arctic desert and icecap)

LEGAL PROTECTION Total

DATE ESTABLISHED Established on 22 May 1974 by Decree No. 266 as a National Park. Protected under the Conservation Act for Greenland Part IV No. 266 of 22 May 1974 and Executive order on the National Park in Northern and Eastern Greenland of 25 June 1976, ratified further in Landstingslov of 12 November 1980 on Nature Conservation in Greenland. Approved in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Part of north and northeast Greenland including the land and inland ice between Petermann Glacier in the northwest and Kong Oscars Fjord and Rypefjord in the southeast and the adjacent area. 71°-83°N, 11°39'-63°W.

ALTITUDE Sea level to 3,000m on the ice cap. Highest mountain is Petermann Bjerg at 2,940m.

AREA About 70,000,000ha including inland ice, land and territorial waters.

LAND TENURE Government of Denmark

PHYSICAL FEATURES Much of the park is a mountainous landscape with an interior covered by inland ice. The geology is extremely varied and on the east coast the rocks are part of the Caledonian Fold, similar to those in western Norway, formed before the North Atlantic opened up, this being accompanied by volcanic activity in the Tertiary. Granites occur near Mesters Vig, and lower Tertiary vulcanites further north. Coasts are characterized by islands, peninsulas and deep fjords blocked by sea ice for most of the year, and pack ice. One of the unique features Peary Land, over 80°N, the northernmost ice-free land area in the world. Snow covers the whole area for eight months and the sea is frozen, immobilizing the large icebergs. Mean temperature for the warmest summer month is about 6°C in the south and 2.8°C in the north due to the influence of the Arctic Ocean. The average annual temperature lies within the range -9.8°C and -16.7°C. Winter temperature may drop to -40° to -50°C. Mean annual precipitation is 100mm to 600mm.

VEGETATION Most of the park is ice-covered or barren but there are large areas with various high arctic plant communities: shore and marsh vegetation, fell-field, grassland, heathland, moving soils vegetation and freshwater vegetation. There is some relatively luxuriant tundra and high mountain vegetation including willow Salix arctica, dwarf birch Betula nana, crowberry Empetrum sp., bilberry Vaccinium sp., Cassiope sp., mountain avens Dryas sp. and grasses and sedges. The growing season is short. The flora contains 200-300 species including some endemic species such as Saxifraga nathorstii.

FAUNA The park is a major breeding area for polar bear Vrsus maritimus (V) (stable population of 200-500) and musk ox Ovibos moschatus (6,000-12,000). Sea mammals include Atlantic walrus Odobenus rosmarus (100-200), ringed seal Phoca hispida along all the coasts, less common bearded seal Erignathus barbatu, harp seal Pagophilus groenlandicus and hooded seal Cystophora cristata in the southern fjords. Narwhal Monodon monoceros and white whale Delphinapterus leucas occur sparsely. Terrestrial mammals include collared lemming Dicrostonyx torquatus groenlandicus, Canadian arctic hare Lepus arcticus, stoat Mustela erminea, arctic fox Alopex lagopus and some roaming

wolves from Canis lupus Ellesmere Island. There are many species of high-arctic birds including the great northern diver Gavia immer, barnacle goose Branta leucopsis, pink-footed goose Anser brachyrhynchus, eider Somateria mollissima, king eider S. spectabilis, gyrfalcon Falco rusticolus, snowy owl Nyctea scandiaca, sanderling Calidris alba, knot C. canutus, ptarmigan Lagopus mutus and raven Corvus corax.

CULTURAL HERITAGE Archaeological evidence shows that settlement occurred from about 3000 B.C. in at least four moves by Inuit, or Eskimo, people.

ZONING/CONSERVATION MANAGEMENT Due to the large area of the park definition of formal core and buffer zones is unnecessary. Access to the park is controlled strictly, by permit only except for inhabitants of the towns of Thule and Scoresbysund, who can continue traditional hunting. There is an advisory committee the National Park Board, set up by the Home Rule Authorities.

STAFF No personnel are permanently assigned to protection, maintenance or research. The 'Sirius patrol', a group of dog-sledges with air assistance, is operating permanently in the area for the Danish government, to check on visitors to the park.

LOCAL ADMINISTRATION The Ministry for Greenland, DK-1128, Copenhagen K, Denmark.

VISITOR FACILITIES Access is difficult and there are no facilities at present but future provision will be made for tourist visits to places of special biological and archaeological interest.

SCIENTIFIC RESEARCH AND FACILITIES Scientific expeditions must apply for permission to visit the park. Since the turn of the century there have been numerous expeditions through northeast Greenland studying geology, climatology, glaciology, flora, fauna and archaeology. Since World War II important geological investigations have been carried out by the Greenland Geological Survey (GGU). There is an earthquake monitoring station at Danmarkshavn. Current research on the polar bear population is sponsored by the Danish government, Danish Research Council and WWF. Desirable research projects include investigation of factors influencing the productivity of plant and animal populations. There are weather stations at Danmarkshavn and Station Nord. There are a number of primitive huts built by expeditions and trappers in most parts of the park, an airfield at Mesters Vig and airstrips at Station Nord, Daneborg and Danmarkshavn. The headquarters for Sirius sledge-patrol are at Daneborg and Ella O.

LOCAL POPULATION The only people living in the park are about 40 in the permanent stations and airport at Mesters Vig. The inhabitants of Thule and Scoresbysund however have traditional rights to enter for hunting.

MODIFICATION OF THE NATURAL ENVIRONMENT There are no major disturbances to natural ecosystems as there is no resident human population. Some mining activity occurs at Mesters Vig. There is limited surveillance staff for such a large area, but at present this is not a problem. Reindeer disappeared from the area in 1900 and wolf in 1934.

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Archipielago de Colon (Galapagos)

BIOGEOGRAPHICAL PROVINCE 8.44.13 (Galapagos Islands)

DATE ESTABLISHED The park was 14 May 1936 and ratified by Decree No. 17, 4 July 1959. After final establishment of the boundaries in 1968, 88% of the land area of the archipelago was included in the park. Accepted as a World Heritage Site in 1978 and accepted as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION The Galapagos Archipelago is situated in the Pacific Ocean, 972km from the mainland of Ecuador with the equator running through Wolf and Ecuador Volcanoes on Isabela Island. 1°40'N-1°36'S, 89°16'-92°01'W.

ALTITUDE 0-1,707m (Wolf Volcano)

AREA 766,514ha, comprising 96.6% of the land area of the archipelago.

LAND TENURE State

PHYSICAL FEATURES Situated on the Galapagos Submarine Platform, the Galapagos Islands consist of 19 oceanic islands, the larger ones being Isabella, Santa Cruz, Fernandina, San Salvador and San Cristobal. Lying on the Equator, this region should be hot and humid, but the cold Humboldt current and two offshoots of the Antarctic current modify the climate of the islands, the large surrounding body of water absorbs the heat. The cold currents cause condensation which produces short and frequent rains. June-November mean temperature of 22°C with frequent mist and drizzle. December-May mean temperature of 25°C and infrequent rain. In geological terms, the islands are young and it is calculated that even the oldest parts are only 3 million years old. All of them were formed by volcanic processes and each represents the summit of a huge volcano, some of which rise over 3,000m from the floor of the Pacific Ocean. There is still constant volcanic activity and eruptions still occur, the last are being in 1968 on Isabela. There is considerable variation in altitude, area and orientation between the islands which, combined with their physical separation, has contributed towards the species diversity and endemism on particular islands.

VEGETATION There are approximately 625 species and subspecies native to the islands of which 36% are endemics. 250 species are non-native introductions occuring predominantly around the human settlements. The coastal vegetation is dominated by the mangrove swamps of Rhizophora mangle, Avicennia germinans, Laguncularia racemosa and Sesovium sp.. The dry zone is characterised by the cactus species Brachycereus, Jasminocereus thouarsii, Opuntia sp.. Bursera graveolens and Croton escouleri. The humid zone is characterised by Scalesia sp., Psidium galapagenium and Pisona floribunda. There is also the Miconia robinsoniana-dominated zone and Cyperaceae, grasses and ferns (in particular Cyanthea weatherbyana) are found on the highest parts.

FAUNA The endemic fauna includes invertebrate, reptile and bird species. There are a few indigenous mammals and a notable paucity of species of amphibians. All the reptiles are endemic except two species of marine tortoises and include the giant tortoise Geochelone elephantopus (E) with 11 subspecies on different islands all of which are Endangered, terrestrial iguanas Conolophus subcristatus and C. pallidus, marine iguana Amblyrhynchus cristatus, numerous lizards of the genus Tropidurus and salamanders Phyllodactilus spp.. The avifauna includes 13 species of Darwins finches Geospiza spp. (including Floreana large ground finch G. magnirostris (I)), mangrove finch Camarhynchus heliobates (R), the dark-rumped petrel Pterodroma

phaeopygia (E), flightless cormorant Nannopterum harrisi (R), Galapagos penguin Spheniscus mendiculus (O), dusky gull Larus fuliginosus, greater flamingo Phoenicopterus ruber, Charles mockingbird Nesomimus trifasciatus(R) and Galapagos hawk Buteo galapagoensis (R). The few mammals present include 2 genera of rat Oryzomys and Nesoryzomys, bat Lasiurus brachyotis, Californian sealion Zalophus californianus and fur seal Arctocephalus australis galapagoensis (O). A marked characteristic of the animals is their tameness. They used to be abundant in the Quaternary period and now occur on 11 of the Galapagos Islands, each islands population with its own distinctive shell form.

CULTURAL HERITAGE The Galapagos Islands were reportedly first discovered by the Incas in the middle of the 15th century, according to the writings of Miguel Caballo de Balboa in 1586. Approximately a hundred years later, the islands were christened Las Islas Encantadas by a Dominican monk ship wrecked there and from then on they were used as a stopping-off place by sailors, buccaneers and whalers. In 1835 Charles Darwin visited the Galapagos while on his vogage abroad the explorer ship Beagle and his observations while there, on species diversity between the islands were later to support his theory of evolution. Despite visits by passing ships, the islands remained largely unsettled until the end of the last century.

ZONING/CONSERVATION MANAGEMENT The management plan defines the following zones: Intensive Use (for visitors); Extensive use (with the most stringent restrictions) and Special Use (basic scientific). Until 1960 little importance was attached to conservation and preservation of the islands and several species are consequently on the verge of extinction. Since 1973 the Government has been helping to maintain this living museum by: preventing hunting particularly of tortoises and seals; eliminating pests such as goats that have destroyed flora particularly Scalecia spp.; controlling the pigs that have reduced the tortoise population; and controlling the imported ant which is invading the territory and destroying the native ant. Successful breeding programmes for the threatened tortoise population have been developed. Management plans are indicated in the Conservation and Selective Development Plan for the Galapagos Islands drawn up by the Government of Ecuador. Legislation and field control have been effective in stopping human destructive action and expansion of competitive exotic introductions. The Scientific Station advises the National Park Service of the Galapagos on protective programmes for the biota, tourism policies and environmental education programmes. Publications are available on the islands and at the University of Ecuador.

STAFF One superintendent, three professionals, six technicians, 15 park guards and two administrators.

LOCAL ADMINISTRATION Superintendente Parque Nacional Galapagos, Puerto Ayora, Isla Santa Cruz, Galapagos. Gobernacion (administration) for the Colon Archipelago, San Cristobal Island, Puerto Baquerizo Moreno.

VISITOR FACILITIES Approximately 20,000 tourists visited the islands in 1984, travelling from island to island aboard large cruise ships, or arriving by plane and using smaller boats. Regulations concerning where people may go and what they can do are quite strong. Licensed guides are provided. According to the master plan visitors should be restricted to 12,000 per year.

SCIENTIFIC RESEARCH AND FACILITIES Research projects include studies of the island ecosystems; ecology of and conservation strategies for the fauna and flora; geomorphology and climate; and studies of introduced plant and animal species. Charles Darwin Research Station established in 1959 on Santa Cruz

Island supported jointly by the Government of Ecuador, IUCN and Unesco. Particular emphasis is placed on work programmes which will assist in the management of the park.

LOCAL POPULATION No information

MODIFICATION OF THE NATURAL ENVIRONMENT The ecological balance of the islands is threatened by the introduction of predators, competitors and exotic plants including guayaba Psidium guajava, citrus, avocados, cascarilla Cinchona and elephant grass Pennisetum purpureum that invade the territory of native species. The resident population of the islands, their associated domestic animals (donkeys, goats, cats, dogs and pigs) and their parasites (ants, ticks and fleas) also damage the wildlife. In the past the populations of giant tortoise and fur seals were depleted by visiting ship crews. Tourist pressure is increasing rapidly. A fire, believed to have been started by the careless disposal of a cigarette into the dry vegetation on 28 February, 1985, was still burning in June 1985 (New Scientist, 1985). A 74km fire break was constructed by teams of fire fighters from the Ecuadorean Army and Navy, and fire experts supplied by the U.S. Agency for International Development and the U.S. Peace Corps. A consequence of the fire fighting efforts is that areas formerly inaccessible can now be reached along the bulldozer trails; there are fears that poaching may increase with insufficient manpower to patrol the fire break and maintain security since the army personnel left. An additional source of disturbance is the periodic phenomeno El Nino which in 1982-83 was responsible for the loss of large numbers of birds and iguanas.

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Omayed Experimental Research Area

BIOGEOGRAPHICAL PROVINCE 2.18.07 (Sahara)

LEGAL PROTECTION Total

DATE ESTABLISHED Accepted as a Biosphere Reserve in October 1981.

GEOGRAPHICAL LOCATION In the Gebel Mariut-Khashm El-Eish Depression, 7km south of the village of Omayed, 80km west of Alexandria and 20km south of the Mediterranean coastline. 30°45'N, 29°12'E.

ALTITUDE 0-110m

AREA 1,000ha

LAND TENURE Provincial Government

PHYSICAL FEATURES The region is covered by sedimentary formations ranging from Miocene to Holocene. The latter are composed of beach deposits, sand dunes, wadi fillings, loamy deposits, lagoonal deposits and limestone crusts. At an altitude of 45m: mean annual temperature of 12.7°C in January and 25.5°C in August and mean annual precipitation of 150mm.

VEGETATION The vegetation of the northern section of the western desert of Egypt belongs to the Thymelaea hirsutae- Noaea mucronata association with a wet variant dominated by Asphodelus microcarpus and a dry variant dominated by Achillea santolina; and Anabasis articulata-Suaeda pruionosa association. The vegetation is differentiated into groupings dominated by Asphodelus microcarpus, Echiochilon fruticosum, Plantago albicans, Anabasis articulata and Atractylis carduus. Other important species are Thymelaea hirsutae, Gymnocarpus decandrum and Helianthemum lippii, which in some vegetation groups share dominance.

FAUNA The fauna is not well known. Mammals include hare Lepus capensis, fat sand mouse Steatomys sp. and gerbils Gerbillus spp.. Birds include kestrel falco sp. and quail Conturnix sp..

ZONING/CONSERVATION MANAGEMENT There is a core area of 100ha with complete protection from grazing since 1974, and three areas of 25ha each with controlled grazing (25% and 50%). Outside these, there is free grazing and traditional land uses. A management plan is proposed. Grazing is controlled to varying extents for experimental puroses. The local population is involved in protection and hired to help with experiments.

STAFF Total staff of 100, including 60 researchers

LOCAL ADMINISTRATION c/o REMDENE, PO Box 589, Alexandria, Egypt.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES This area was one of the principal sites of continuous research by SAMDENE (1974-1979) and REMDENE (1979-1984) on soil, climate, flora and fauna. There is monitoring of climate, vegetation, soil, hydrology, plant and animal populations, behaviour of grazing animals and harvesting. 60 research staff. There is a research station, field station, climatic station, experimental plots and accommodation for scientists are available.

LOCAL POPULATION There is a small scattered human population with partial nomadism and free grazing. The local community assists in running the reserve and monitoring the experiments.

MODIFICATION OF THE NATURAL ENVIRONMENT The core area has regeneration of soil and vegetation indicating the significance of protection from overgrazing. Disturbances include rain-fed pig farms and a major road which runs through the reserve.

PRINCIPAL REFERENCE MATERIAL
None listed

Atoll de Taiaro

BIOGEOGRAPHICAL PROVINCE 5.04.13 (Southeastern Polynesian)

LEGAL PROTECTION Proclaimed a strict reserve by its owner, with the agreement of the Governor of French Polynesia by decree no. 2456/AA of 1 August 1972. (Journal Officiel de la Polynésie Française).

DATE ESTABLISHED The lagoon was scheduled as the Réserve Intégrale W.A. Robinson on 1 August 1972; but the reserve extended to cover the entire atoll and surrounding 1km protective buffer zone in February 1973. Accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In the Tuamotu Archipelago in the west Pacific, 540km east northeast of Tahiti and 230km east of Raroia atoll. 15°44'S, 144°38'W.

ALTITUDE 0-5m

AREA 2,000ha

LAND TENURE Private property

PHYSICAL FEATURES An almost circular atoll 5km in diameter enclosing a lagoon (previously connected by several channels) with water slightly saltier than that of the ocean due to excess rainwater evaporation. The emergent belt of the atoll measures 700m from the sea to the lagoon at its widest part, and has a circumference of about 12km. The lagoon bottom at between 22 and 25m depth is apparently homogenous in its morphology.

VEGETATION This atoll is unusual in that it is covered, not with coconut palms Cocos nucifera like most Tuamotu and Pacific atolls, but mainly with an open bush vegetation, including the following species: Lepidium spp., Morinda citrifolia, Pandanus spp., Suriana spp., Pemphis acidula, Erithalis polygama, Petesia carnosa, Guettarda speciosa, Scaveola sp., Tournefortia spp., Pentacarya anoniala, Myoporum spp., Voerhavia spp., Achyrantes spp., Cassytha spp., Euphorbia ramosissima, Urtica spp., Digitaria spp., Psilotum spp., Polypodium spp., Asplenium spp. and Ramalina spp. as well as the coconut.

FAUNA There is an abundance of fauna in the lagoon, including the molluscs Tridacna maxima, Pinctada maculata, Codakia divergens, and Gafrarium pectinatum, (23 species in total) the echinoderm Holothurai (Halodima) atra and fish (50 species), but with a relative paucity of corals, with only Parites lobata present, down to a depth of 1.5m. Abundant coral fauna are found in the outer reefs, with a well-developed algal crest in the windward parts (south and south-east) of the island.

ZONING/CONSERVATION MANAGEMENT Buffer zone around atoll. There is close cooperation between the owner of the property, the Administrative Committee of the sanctuary and the Governor of French Polynesia for protecting the atoll. Visits are by special permission.

STAFF A guardian and his family. Transient scientific missions.

LOCAL ADMINISTRATION Management Committee Secretariat, Conservateur, Délégué de la Commission des Monuments Naturels et Sites, BP 866, Papeete, Tahiti.

SCIENTIFIC RESEARCH AND FACILITIES The earliest scientific work - botanical and malacological (mollusc) collections - dates from the late 1830s (US

Exploring Expedition). In 1970 an experiment was begun to study competition between two mosquito species, Aedes polynesiensis, an abundant resident species and a vector of the human filariasis, and Aedes albopictus which was introduced into the island. This research was conducted by the Pacific Research Section of the National Institute of Allergy and Infectious Diseases based at Honolulu, Hawaii. In 1972, a scientific mission was sent to the atoll by the Museum National d'Histoire Naturelle (Paris) and the Ecole Pratique des Hautes Etudes (Tahiti). Its purpose was to construct a floristic and faunistic inventory of the lagoon and the reefs and to study the distribution and ecology of species living in the marine environment, the geomorphology of the atoll, and the hydrology of the lagoon. The atoll offers interesting opportunities for research into the ecology and evolution of atoll lagoon coral ecosystems as well as the archaeology of the region. The owner of the island provides housing for visiting scientists.

LOCAL POPULATION Today the only permanent inhabitants are a family of the guardian.

MODIFICATION OF THE NATURAL ENVIRONMENT In the past, several plant species (especially the coconut) appear to have been introduced onto the atoll, which was then the centre of a small but flourishing Polynesian kingdom.

PRINCIPAL REFERENCE MATERIAL

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Forêt domaniale du Fango

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In north-west Corsica, on the southern slopes of the Fango Valley in the Galeria region near Calvi; within the administrative bounds of the commune of Manso. 42°23'N, 08°46'E.

ALTITUDE 100-1,300m

AREA 6,410ha

LAND TENURE State government

PHYSICAL FEATURES The Fango Valley is cut in deposits of rhyolite which have filled an older granitic channel. The slopes are generally steep and the river itself fast flowing. The mediterranean climate has hot dry summers and warm winters when most rain falls.

VEGETATION The natural vegetation of most areas is well preserved scrub of evergreen holm oak Quercus ilex but various types of maquis also occur. Up to 300m, myrtle Hyrtus sp., maquis strongly dominates; up to about 900m submediterranean maquis is dominant. These types of maquis form part of the successional series leading to holm oak. The maritime pine Pinus pinaster and Corsican pine P. nigra are rare, appearing in strength only on the crests of the southern and, especially, the eastern peripheries at about 900-1,100m, a few copses and isolated trees growing as high as 1,200-1,300m. The undergrowth consists of brushwood and, in damp areas, alder Alnus sp. and box Buxus sp. with a flooring of ferns.

FAUNA Mouflon Ovis orientalis occur on the higher mountains where parts of the eastern slopes fall within the Asco National Reserve. In the humid rains there are wild boar Sus scrofa and many deer (Cervidae) throughout the area. Many migrant birds overwinter here. Nesting birds include golden eagle Aquila chrysaetus, lammergeier Gypaetus barbatus and corsican nuthatch Sitta whiteheadi. The varied insect fauna includes 13 endemic beetles (Coleoptera) of the 32 species present.

CULTURAL HERITAGE The area was managed for a long time by nomadic herdsmen from Niolo, on the eastern side of Corsica who preserved the evergreen oak forest. Its leaves and acorns were the only food for their livestock on arrival in autumn, as the grass grew only after the spring rains and chestnut trees were scarce.

ZONING/CONSERVATION MANAGEMENT Core zone: state owned forest with tall, well-grown trees. West buffer zone: Tetti and Luccio forests. North buffer zone: degraded oak forest as far as the Fango, with high and low maquis. East buffer zone: rocky flanks of the Cinto with sparse vegetation. South buffer zone: towards the ridges oak forest giving way to pine groves. The forest is within the Corse Regional Park (150,000ha).

STAFF None

LOCAL ADMINISTRATION Laboratoire de Pirio, Manso, 20245 Galeria; Lycée de Bastia, 20200 Bastia.

VISITOR FACILITIES No special facilities exist but the surrounding Corse Regional Park has unrestricted access and a number of marked footpaths.

SCIENTIFIC RESEARCH AND FACILITIES Multidisciplinary ecological studies are being undertaken under contract with the DGRST (Délégation Générale à la Recherche Scientifique et Technologique) including: degradation, protection, regeneration of the maquis; flora and fauna; hydrology and climatology; socio-economic and demographic problems; studies of the dynamics of an oak forest; past and present value and future prospects of the oak forest which is static at present, possibly integrated in an overall study of typical Mediterranean forests because of its specific character, past economic role, conservation and protection; comparison with other forests of the Mediterranean periphery and with other oak forests for example the cork-oak forests of Sardinia and southern Corsica. The Pirio Laboratory of the Association for Ecological Study of the Maquis (Association pour l'Etude Ecologique du Maquis, APEEM), is situated in Manso, and this is a modest country laboratory, where working parties have been meeting for the past three years, and where courses are held. The Pirio Meteorological Station has been operating since January 1974. A station for hydrological measurements has also been established on the Fango river.

MODIFICATION OF THE NATURAL ENVIRONMENT The oak forest is static at present and regeneration needs to be encouraged, especially in degraded areas. There are no staff specifically assigned to the reserve.

PRINCIPAL REFERENCE MATERIAL
None listed

Réserve nationale de Camargue BR

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The nature protection area was founded in 1928 and administered by the Société Nationale de Protection de la Nature, a private organisation. On 24 April 1975 it was taken over by the state to form a strict nature reserve and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Between the two major distributaries of the Rhône delta, on the Mediterranean sea, just south of Arles in the département of Bouches du Rhône. 43°30'N, 4°30'E.

ALTITUDE 0-4m

AREA 13,117ha

LAND TENURE Government

PHYSICAL FEATURES The reserve is situated in the centre of the Rhône delta and includes coastal dunes and older dunes, now about 5km from the present coastline, salt steppe and lagoons of varying sizes and salinity. The largest lagoon, the Etang de Vaccarès, covers 6,500ha and is slightly brackish with 3-6g of salt per litre. Behind the coastal dunes is a long lagoon with high salinity; further from the present coast there is a network of brackish lagoons while some small bodies of water, mostly outside the strict reserve's boundaries, are fresh water. Water levels vary, and in the reserve the area of land submerged is 60% in summer but 95% in winter. With summer evaporation, salinities also become higher, some lagoons becoming more saline than the Mediterranean itself while others dry out to form salt pans. The area has a mediterranean climate with hot, dry summers and mild winters with most rainfall in autumn and winter, an annual total of about 500mm. Temperatures are highest in July, which has a mean of 23°C and coolest in January, mean 6°C. Most months are windy, and for six months the mistral, a dry wind from the north-west, blows, which increases evaporation considerably. The lagoon waters are warm, being an average 0.5m deep, maximum 1.8m deep.

VEGETATION The varying habitats, salinities and age of the land in the reserve means that a range of stages of plant succession are present with most plants being salt tolerant. The coastal dunes carry marram grass Ammophila arenaria and herbs including the lily Pancratium maritimum. Behind these, salt steppes have a sparse covering of the glasswort Arthrocnemum glaucum interspersed with brackish lakes which, apart from algae, only support submerged tassel pondweed Ruppia maritima. Further inland, with lower salinities, the steppes are more densely vegetated with the glasswort

Salicornia fruticosa; areas are often flooded in winter. In the north of the Etang de Vaccarès the salt-loving Ruppia spp. give way to pondweeds Potamogeton spp. and water buttercups, with reeds Phragmites communis, bulrushes Scirpus spp. and sedges along the shores. In areas with low salt contents a dry grass community of Thero-Brachypodion occurs and on ancient inland dunes juniper Juniperus phoenicea predominates. The vegetation is analysed in detail in Britton and Podlejski (1981).

FAUNA The Camargue is particularly noted for its birdlife. It is the only regular breeding site in Europe and North Africa for greater flamingo Phoenicopterus ruber (5,000 pairs) and the only breeding place in France for several other species: gull-billed tern Gelochelidon nilotica (250-300 pairs), pratincole Glareola pratincola (150-200 pairs), cattle egret Bubulcus ibis (100 pairs) and squacco heron Ardeola ralloides. About 200,000 ducks Anatidae overwinter and there are many waders including avocet Recurvirostra avosetta and black-winged stilt Himantopus himantopus. Other interesting birds include european bee-eater Merops apiaster, common roller Coracias garrulus and penduline tit Remiz pendulinus. Mammals include beaver Castor fiber, wild boar Sus scrofa, fox Vulpes vulpes and coypu Myocastor coypus. Both freshwater fish, such as pike perch Lucioperca lucioperca and pike Esox lucius, and sea fish like sole Solea vulgaris and sea bass Morone labrax are present, as well as brackish water species. Many eel Anguilla anguilla are present. The Camargue's ecology is described in detail in Hoffmann (1958).

CULTURAL HERITAGE The Camargue is traditionally a grazing area for semi-wild horses, cattle and sheep. The area within the reserve has remained unsettled as it is too costly to drain for the intensive agriculture which has encroached in the rest of the area.

ZONING/CONSERVATION MANAGEMENT The reserve is surrounded by the Camargue Regional Natural Park of 85,000ha. This includes natural areas outside the reserve, the Imperial Reserve to the west and Tour du Valet Private Reserve to the east and acts as a buffer zone. Access to the reserve and exploitation of it are strictly limited. Shooting is prohibited but this is very popular, although subject to restrictions, outside the reserve. Grazing and salt extraction are also not allowed. In the national park, which acts as a buffer to the nature reserve, policies include limiting the spread of salt pans, subsidising traditional land uses, diverting drainage of agricultural areas into the Rhône rather than the Etang de Vaccarès and organising tourism to minimise damage to the environment. Special management has been necessary to prevent flamingoes invading ricefields at night after a dry winter in Africa in 1977 caused many more to winter here. Bird scaring devices are set off throughout the evening, which is more acceptable than farmers shooting the tresspassers. The carrying capacity of the area for breeding flamingoes has also been increased. They rest on islands, removing the vegetation to make a nest mound which makes the islands more susceptible to erosion. Islands have been created artificially and mounds made from clay and mud.

STAFF This includes a Director, accounting clerk, technician and three guards.

LOCAL ADMINISTRATION M. le Directeur de la Réserve de Camargue, 1 rue Stendhal, 13200 Arles, France.

VISITOR FACILITIES Access to the biosphere reserve is strictly limited, by permit only. However, the rest of the Camargue is a major tourist attraction, with well developed facilities.

SCIENTIFIC RESEARCH AND FACILITIES Permanent research programmes have been conducted since 1954 by the Station Biologique de la Tour du Valat, a privately run research station, in cooperation with Centre Nationale de la Recherche Scientifique, and since 1970 by CNRS themselves. About ten organisations are involved in research and efforts are being made to coordinate work by the Délégation Générale à la Recherche Scientifique et Technique (DGRST). A project to monitor pollution was funded by WWF Project 1034 from 1971 to 1976. A permanent means of baseline data collection is being set up. There is a research station, the Centre d'ecologie de la Camargue, run by CNRS. Permits to enter the reserve for scientific work can be obtained from the Director.

LOCAL POPULATION On the reserve the only buildings are two wardens' lodges. In the surrounding Natural Park, however, there are groups of houses, mainly in the areas of intensive agriculture. The town of Arles is only about 10km to the north.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve has only been slightly altered by human action, including grazing and salt extraction from 150ha over a hundred years ago. However, the same is not true for the delta as a whole. The geomorphological evolution of the delta was arrested in 1860, when it was dyked and since then, man has harnessed the water, pumping it or discharging it into the Rhône and therefore has some influence over water levels and salinity in the centre of the delta. Changes in rice-growing have had a special impact, with the introduction of large volumes of fresh water (1950-1960) and then the gradual abandonment (1960-1976) of this type of cultivation. Tourists and campers are causing increasing disturbance and sometimes invade the coastal part of the reserve. Air pollution from nearby industry is increasing, and there is an inflow of excess water from agricultural land, which has washed out part of the salt content from some of the étangs and introduced increasing amounts of toxic chemicals. Hunting close to the reserve threatens some game species.

PRINCIPAL REFERENCE MATERIAL

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Réserve de la biosphère du PN des Cévennes

BIOGEOGRAPHICAL PROVINCE 2.09.05 (Atlantic)

LEGAL PROTECTION The core zone is fully protected but the park regulations do not apply to the buffer zone.

DATE ESTABLISHED The National Park was established on 2 September 1970 under Order 70-777 and is protected under the French National Parks Act, 1960. An area roughly coincident with the National Park was accepted as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION In the départements of Lozère, Gard and Ardèche on the extreme south-east of the Massif Central, about 120km from Nimes and Montpellier, 49°20'N, 1°40'E.

ALTITUDE Maximum 1,700m

AREA Total 323,000ha; core zone 85,000ha

LAND TENURE Core zone: 30,000ha government; 6,000ha common land; 49,000ha private ownership. Buffer zone: mostly private ownership.

PHYSICAL FEATURES The park is geologically and scenically diverse. In the north is the granitic massif of Mont Lozère which is 40km by 15km and rises to 1,700m. The central area is composed of schist and granite, and cut by valleys opening towards the Mediterranean; the Aigoual Massif here forms the watershed between Mediterranean and Atlantic drainage. In the west the limestone plateau of Causse Mejcan is an undulating area bounded by deep gorges, like the Tarn and Jonte valleys. At an altitude of 900m, the mean annual temperature is 8°C and precipitation 1500mm per annum. At the Aigoual Observatory at 1,567m altitude, mean annual temperature is 4.2°C and annual precipitation 2242mm.

VEGETATION The variety of rock types and altitudes in the park has caused a diverse and interesting flora to develop. In general the flora is sub-mediterranean, with about 1,800 species present. There is forest with mediterranean, atlantic or middle european mountain characteristics. Coniferous forest covers about a quarter of the park, the main species being scots pine Pinus sylvestris, Salzmann's pine P. clusiana ssp. salzmanni and silver fir Abies alba. There are a variety of introduced conifers. Broadleaved forest covers a similar area, generally at lower altitudes, and includes beech Fagus sylvatica, silver birch Betula pendula, white oak Quercus pubescens, holm oak Q. ilex and sweet chestnut Castanea sativa. Heather Calluna vulgaris dominated moorland covers about 20% of the park where soils are acid, smaller areas of grassland occur on calcareous and siliceous soils and in poorly drained areas there is bog vegetation including sphagnum Oxycoccos quadripetala.

FAUNA The fauna is diverse, due to the variety of habitats and mixture of maritime, mediterranean and continental influences. About 50 mammal, 150 bird, 30 reptile and amphibian and 20 fish species have been recorded. There are many wild boar Sus scrofa and some genets Genetta genetta. The avifauna includes many birds of prey, such as golden eagle Aquila chrysaetos, peregrine falcon Falco peregrinus and eagle owl Bubo bubo.

CULTURAL HERITAGE Much of the characteristics of the landscape are derived from man's influence. The Causses were the meeting place of two megalithic civilizations and there are many dolmens, menhirs and cromlechs remaining from the fourth and third centuries B.C. These limestone areas were once forested, but this was cleared during Roman times for firewood and resin leading to soil erosion, which exposed interesting limestone formations, like the 'lauzes'. In the schist areas, cultivation is difficult due to the steep slopes, so for centuries these have been terraced. Development in the Cévennes has been related to two trees, the chestnut and mulberry but most of these were killed by disease at the end of the nineteenth century. The forest at Aigoual was almost totally destroyed, leading to erosion and floods but massive reforestation was undertaken and now forest covers almost all the mountain.

ZONING/CONSERVATION MANAGEMENT The central zone of the national park coincides with the rehabilitation and traditional experimental and core zones of the biopshere reserve. The national park's zone of cooperation corresponds to the biosphere reserve's buffer zone, but boundaries are not exactly coincident, the biosphere reserve's being based on vegetation boundaries and including the Tarn river gorge. In the core zone, 17% of the area (15,000ha) consists of game reserves. In the core area, park officials have important statutory authority to supervise hunting, building licences, traffic etc. and a board of 50 directors meets twice a year to discuss policies and problems. The buffer zone is not directly under their control and park officials can only advise and persuade. There was a management plan due to be effective from 1981-1985. About 600 people live in the core area, and their way of life is closely connected to the area's character; management policies aim to preserve this way of life, as well as the natural features of the park, by subsidies for such matters as using traditional materials for building repairs, gates and employing farmers for park work when they are not busy farming. A programme of winter social gatherings, meetings and summer educational activities for the local population as well as tourist information facilities is organised by the Centre d'Animation Cévenol, and operates in the buffer zone as well. An interdepartmental advisory committee from Gard, Lozère and Ardèche has approved a programme of development for the buffer zone, which aims to maintain the present population but improve living conditions and develop tourism. There are measures to reintroduce some animals, including griffon vulture Gyps fulvus, which now breed in the Tarn gorge. A semi-reserve has been set up, covering 1200ha, to try and establish a viable population of the Przewalski horse Equus przewalskii, partly supported by WWF-France (Bouman, 1984).

STAFF There was a staff of 62 in 1980, including Park Director and assistant, 35 administrative staff, six researchers and 27 technical staff attached to research work.

LOCAL ADMINISTRATION Parc national des Cévennes, 48400 Florac.

VISITOR FACILITIES In the core zone, camping and caravanning is only allowed in close proximity to permanently inhabited areas. There are also 48 'gites', simple self-catering accommodation, built on farmers' property with financial assistance from the park and three country inns at Cabrillac, l'Hospitalet and la Croix de Berthel. The main hotel centres are in the buffer zone. An information bureau at Chateau de Florac is open all year and in summer there are six further centres. There are many information leaflets and two publications. There is a museum on Mount Lozère. Main roads cross the park from which circular walks of varying lengths have been signposted, and guided tours with a special theme are organised in summer. There are many bridle paths, several horse-riding centres and facilities for skiing on Mont Lozère and Mont Aigoual. In summer, a series of concerts is organised in buildings of particular archaeological interest.

SCIENTIFIC RESEARCH AND FACILITIES Past and future research is concentrating on assessing the best means of managing the park to maintain an equilibrium between human activities and the environment. Research financed by C.E.E. from 1978-1980 concentrated on Mont Lozère and from 1981-1983, PIRENS-CNRS financed studies of the Aigoual-Lingas region. Park staff help with scientific observations and day-to-day monitoring. There is a meteorological station on Mont Aigoual and some accommodation set aside for about 30 workers.

LOCAL POPULATION About 600 people live in the core zone in villages, hamlets and isolated farms. In the buffer zone there are about 40,000 permanent residents. Farming and forestry are major occupations.

MODIFICATION OF THE NATURAL ENVIRONMENT The park authorities do not have direct control over the buffer zone, although there is a high degree of cooperation by the local people. A number of species of animals once resident have disappeared, and some reintroductions are being undertaken. Much of the landscape is man-modified and, although this has led to much of its special character, maintaining an equilbrium between man and nature requires careful management.

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Réserve naturelle intégrale d'Ipassa-Makokou

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION Hunting, fishing and cultivation is forbidden in the reserve.

DATE ESTABLISHED 2 October 1970 by decree. Approved as a Biosphere Reserve in 1983.

GEOGRAPHICAL LOCATION On the banks of the River Ivindo in north-east Gabon, 600km from the sea and 15km from the town of Makokou in the province of Ogooue-Ivindo. 0°31'N, 12°48'E.

ALTITUDE 450-500m

AREA 15,000ha, with a core area of 10,000ha

LAND TENURE Provincial

PHYSICAL FEATURES The base rock of the region is mostly Precambrian material, with crystalline formations of leptinite, basic lava, granites and gneisses and sedimentary formations of muds, conglomerates and clays. A succession of clay alluvia lines the forested valley floors. The River Ivindo winds through part of the reserve. Mean annual temperature is 23.9°C, and mean annual rainfall is 1754mm.

VEGETATION The vegetation comprises humid dense evergreen lowland forest of the Congo-Guinean phytogeographic region. More than 2,000 plant species have been recorded. There are several rare or endemic species found within the reserve, including Ardisia belingaensis and Rhaptopetalum belingensis.

FAUNA Over 600 species of vertebrate have been recorded. Particularly worthy of mention are the mandrill Papio sphinx (T), bushpig Potamochoerus porcus, and water chevrotain Hyemoschus aquaticus. Also present are blue duiker Cephalophus monticola, white-bellied duiker C. leucogaster, black-fronted duiker C. nigrifrons, Peter's duiker C. callipygus, bay duiker C. dorsalis, sitatunga Tragelaphus spekei, bongo T. euryceros, and buffalo Syncerus caffer.

ZONING/CONSERVATION MANAGEMENT There is a core zone of 10,000ha with a fixed quadrat site, and a surrounding buffer zone (which still contains some plantations). Only research is allowed within the core zone. There is a management plan. A number of projects are in preparation, eg. installing a guard post, and assigning wardens.

STAFF Nineteen people within the reserve

LOCAL ADMINISTRATION Station de l'Iret, BP 180, Makokou.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research, which is concentrated in small blocks, is mainly on birds, fish, reptiles, insects, primates, small ungulates, rodents, and the structure and dynamics of forest and plant-animal interactions. It is principally carried out by foreign institutes. There are continuous monitoring programmes. A comprehensive species list has been compiled. The core area is particularly well studied. The reserve is suited for more applied ecological research using the wealth of data already available. A research station, the Laboratoire de Primatologie et d'Ecologie

Equatoriale, was built in 1968 inside the reserve by CNRS (France). It was nationalised in the late 1970s by the Gabonese Government to become the Institut de Recherche en Ecologie Tropicale (IRET) but is still supported by CNRS. There is accommodation for 12 scientists, a library, canteen and water tower.

MODIFICATION OF THE NATURAL ENVIRONMENT There are a number of neighbouring villages along the southern bank of the River Ivindo which could put pressure on the reserve. Hunting, fishing and agriculture are a problem. The forest within the core area is relatively undisturbed.

PRINCIPAL REFERENCE MATERIAL

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Steckby-Loedderitz Forest Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION The National Nature Reserve was created by order of the Ministry of Agriculture and Forestry on 3 March 1961. All activities are forbidden in the core zone.

DATE ESTABLISHED Accepted as a Biosphere Reserve in November 1979

GEOGRAPHICAL LOCATION The area occupies both sides of the middle course of the Elbe River between Aken and the confluence of the river Saale in the Zerbst and Schoenebeck county, district of Magdeburg. 51°53'N,11°59'E.

ALTITUDE 50-75m

AREA 3,500ha

LAND TENURE 90% state ownership and 10% cooperative farms.

PHYSICAL FEATURES The reserve comprises 65% forest land, 9% bogs and lakes, 9% river (Elbe), 9% river-bank area and 8% grassland. It is a flood-plain forest with meadow land part of the site being flooded every year by the River Elbe. The geology is Holocene sediments (bottom-land loam) overlay Pleistocene river-bed sands, dunes and deposits of shifting sand. Sediments range from high-nutrient clays, podsolic brown earths to poor sands. Mean annual temperature of 8.7°C (January mean of 0°C and July mean of 18.5°C) and mean annual precipitation of 545mm.

VEGETATION The area has extensive pine Pinus sylvestris forest on dune systems (up to 15m in height) and hardwood and riverine forests (covering 1,500ha) with Quercus robur, Ulmus carpinifolia, U. laevis, Carpinus betulus, Acer campestre, including wild fruit species of Pyrus achras, Malus sylvestris and Pyrus pyraster with hybrids of the cultivated forms over a ground flora of Stellaria holostea and Polygonetum multiflorum; grassland with Filipendula hexapetala, Ranunculus polyanthemus, Deschampsia caespitosa, Galium boreale, Silaum silaus, Inula salicina, Peucedanum officinale, Serratula tinctoria, Cnidium dubium, Selinum carvifolia, Lathyrus palustris and Iris sibirica; and ox-bow lakes lakes with Salvinia natans and Trapa natans. In total some 50 species are present which are regarded as endangered and rare in the GDR.

FAUNA A total of 39 mammals have been recorded. The reserve is one of the most important breeding sites of the endangered species Elbe beaver Castor fiber albicus which has been protected since 1913 consisting of 12 colonies. Breeding bird species include lesser spotted eagle Aquila pomarina (in its southwestern-most breeding area), honey buzzard Pernis apivorus, goshawk Accipiter gentilis, black kite Milvus migrans, red kite M. milvus, hoopoe Upupa epops, kingfisher Alcedo atthis, pintail Anas acuta, shoveler A. clypeata and Ortolan bunting Emberiza hortulana. In total 130 bird species breed and it is an important wintering and passage site with over 100 species recorded. There is a remarkable invertebrate fauna including Lucanus cervus, Osmoderma eremita and Ephesia fulminea. Pond terrapins Emys orbicularis are also present. Records exist for over 20 species of fish; 46 species of Araneae, eight of Opiliones, 26 Carabidae, 25 Coccinellidae, 70 Cerambycidae, 180 species of Lepidoptera and 50 species of Mollusca.

ZONING/CONSERVATION MANAGEMENT The nature reserve covers 3,500ha with a core zone of 400ha (after the extension of the site on 10 December 1981) and 100ha of 'regeneration zone'. An extension will be approved in October 1986. A

plan for the development, management and cultivation of the area has been operative since 1985 and was supplemented in 1967 with a forestry programme. The buffer zone is managed according to guidelines established by the Magdeburg District Council.

STAFF Three research workers and two technical staff of the Institute for Landscape Research and Nature Conservation, Halle. Two supervisors employed by the District Council.

LOCAL ADMINISTRATION Rat des Bezirkes Magdeburg, Abteilung Forstwirtschaft - Naturschutz, Olvenstedter Strasse, 4. PSF1, Magdeburg 3010, German Democratic Republic.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research includes inventories of animal populations (since 1920) especially with regard to beavers; bird ringing, studies on the structure and dynamics of lowland forests, and soil and vegetation mapping. Experiments in pest control by birds attracted to nesting boxes have been carried out since 1925, supported by the Association for the Protection of Birds. There are five permanent plots which are used for the detailed study of the structure and dynamics of hardwood forest over time. Potential activities include protection and management of habitats, waterfowl counts, and long-term studies on the structure and dynamics of forest and grassland ecosystems. Field studies are conducted by the Biological Research Station at Steckby, of the Institute of Landscape Research and Nature Conservation of the Academy of Agricultural Sciences. Between 1973 and 1981 the station has reared over 190 great bustards Otis tarda from eggs collected from disturbed nests.

MODIFICATION OF THE NATURAL ENVIRONMENT There are no human settlements in the reserve. Most forest land is unaltered but Ulmus carpinifolia is declining under the impact of graphiosis. Hunting and agriculture are practised in accordance with the needs of nature conservation. There are some shipping activities on the River Elbe and the river is slightly polluted.

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Vessertal Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION National Nature Reserve since 1939. No exploitation in the core area and forestry management and agricultural use are strictly controlled in the remaining area.

DATE ESTABLISHED Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION The reserve covers the southern foothills of the Thuringian mountains between the villages of Breitenbach and Vesser, 8km south-east of the town of Suhl, on both sides of the Vesser river. 50°36'N, 10°48'E.

ALTITUDE 430-750m (at Hohe Buche and Stutenhaus)

AREA 1,384ha

LAND TENURE 90% state ownership (including all forest areas) and 10% private or cooperative ownership.

PHYSICAL FEATURES The Thuringian Forest consists of a moderately high, long (70km) and narrow (5-20km) mountain ridge running north-west to south-east with numerous side valleys. The reserve exhibits slope relief formed by the valley of the River Vesser together with a system of narrow, deep-cut side valleys. There is a dense network of streams but no permanent bodies of standing water. The geological underground consists of volcanic rock and sediments from the Permian formation and early Paleozoic schists. The narrow bottom of the main valley has extensive stratified alluvial sandy gravel deposits from the Holocene. The soils are predominantly brown earth. Annual precipitation of 780-1,100mm varying with altitude and annual temperature of 4.9°C to 6.5°C. The numerous valleys, the differences in the degree of exposure and altitudinal differences result in microclimates giving rise to considerable ecological diversity.

VEGETATION The area comprises 85% forest-land and 15% grassland and includes deciduous and coniferous forests, upland meadows and streams as well as spring habitats and communities of tall perennials. The dominant tree species is Fagus sylvatica with Acer pseudoplatanus and Ulmus glabra alternating locally with mixtures of Picea abies and Abies alba (at the northern parts of its range). Fraxinus excelsior, Alnus glutinosa and Acer platanoides occur in valleys and mountain clefts. Characteristic of the forest soil flora are Luzula luzuloides, Calamagrostis arundinacea, Galium harcynicum, Vaccinium myrtillus, Polygonatum verticillatum, Dentaria bulbifera, Digitalis purpurea and Prenanthes purpurea. Typical species of the grassland are Trisetum flavescens, Geranium sylvaticum, Centaurea pseudophrygia, Polygonum bistorta, Phyteuma orbiculare, Nardus stricta and Arnica montana together with several orchid species, and Primula elatior, Trollius europacus, Phyteuma orbiculare, colchicum autumnale and Botrichium lunaria. The spring areas have Chrysoplenium oppositifoloum and Cardamine amara and the riverine herb

communities includes Filipendula ulmaria, Petasites hybridus and Chaerophyllum hirsutum. Other plants recorded include Matteuccia struthiopteris, Dryopteris oreopteris, Huperzia selago.

FAUNA Mammals include red deer Cervus elaphus, roe deer Capreolus capreolus, wild boar Sus scrofa, pine marten Martes martes, pine vole Pitymys subterraneus and southern water shrew Neomys anomalus milleri. Breeding birds include black woodpecker Dryocopus martius, dipper Cinclus cinclus, grey wagtail Motacilla cinerea and nutcracker Nucifraga caryocatactes. Amphibians include Triturus alpestris; stream fauna includes the alpine flatworm Planaria alpina.

ZONING/CONSERVATION MANAGEMENT Core zone 42ha, buffer or manipulated zone 1,155ha, stable agricultural zone 187ha. The nature reserve lies within the extensive Thuringian Forest Protected Landscape Area. All utilization is prohibited in the core zone and only activities such as mowing of meadows is permitted in the buffer zone. The meadows were previously mown by hand twice a year (early 1960s) and were irrigated by a system of ditches the remains of which are still visible. They are now utilized for hay or pasture. Other areas are grazed but ploughing and use of fertilizers is prohibited. A programme of inventorization is continuing covering such elements as soil, water types, fauna, flora and microclimatic features. The reserve was integrated into the environmental monitoring programme of the GDR in 1981, main targets being plant and animal populations. Management guideline are elaborated by the territorial authorities, the national nature conservation authorities and Institute of Landscape Research and Nature Conservation.

STAFF One part-time supervisor and varying numbers of research workers (two in 1976). General maintenance carried out by forestry and farming workers.

LOCAL ADMINISTRATION Ret des Bezirkes Suhl. Abteilung Forstwirt-schaft-Natur Schutz, 60 Suhl, Rimbachstrasse.

VISITOR FACILITIES Limited tourist activity restricted to a marked footpath

SCIENTIFIC RESEARCH AND FACILITIES Research has included hydrological studies, vegetation mapping, influence of vegetation on river characteristics, animal population studies and vegetation-soil-land use interactions. Detailed mapping has been carried out for certain species with a total of 1,400 one hectare scans having been completed. Long-term research is being performed into forest structure changes of Abies alba refugia. The Thuringian Forest consists of a moderately high, long (70km) and narrow (5-20km) mountain ridge running north-west to south-east with numerous side valleys. Potential research includes the evolution of Central European montane ecosystems and conservation of an area of genetic and ecological diversity. The reserve is easily accessible by car. The reserve is used as a training area for the UNEP/Unesco Post Graduate Training Course on Ecosystem Management held annually at the Technical University of Dresden especially organized for developing world students. There are plans to establish a biological station in the Vesser Valley.

LOCAL POPULATION No human settlements

MODIFICATION OF THE NATURAL ENVIRONMENT The Reserve is sited within extensive highland forests and does not contain any human settlements. Forestry and farming are practised outside the core zone on a contractural basis but much of the reserve is natural unaltered forest. Little evidence of air or water pollution. Limited tourist activity restricted to an officially marked footpath traversing the area.

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Bayerischer Wald National Park

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED 11 June 1969 by the Bavarian parliament; protected as a National Park since 15 March 1973 and accepted as a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION South-east Germany, 200km north-east of Munich, on the border with Czechoslovakia, about 50km north of Passau and the River Danube. 48°55'N, 13°23'E.

ALTITUDE 750-1,450m

AREA 13,100ha

LAND TENURE Bavarian state

PHYSICAL FEATURES The park is situated on a rolling plateau which climbs gently toward the souh-west, reaching its highest elevations on the border peaks. The granite and gneiss bedrock is some 450 million years old. Traces of the ice age in solifluction features, glacial lakes, moraines and peat bogs. There are several types of brown soil on over 80% of the area with podzols in sandy places and swamps and peat bogs in the valleys. At 1,000m, recorded mean annual temperature is 5°C and mean annual precipitation 1,300mm. Snow depths may reach 3m in the highlands. Valley bottoms are often cooler than the slopes, even in summer, and have frequent frosts.

VEGETATION The park is part of the 20,000ha Bohemian forest, the largest in Europe, which lies on both sides of the border between Czechoslovakia and Bavaria. Several types of beech community cover 70% of the area and 98% of the park is wooded. The main tree species are common beech Fagus sylvatica, silver fir Abies alba, Norway spruce Picea abies, sycamore Acer pseudoplatanus, ash Fraxinus excelsior, wych elm Ulmus montana and wild cherry Prunus avium which occur on the warmer slopes. Several types of spruce community cover the rugged highlands over 1150m and in cold and moist valleys grow species such as Picea abies, rowan Sorbus aucuparia, silver birch Betula verrucosa and B. carpathica. Raised bogs, often 5m above ground level, are common with dwarf pine Pinus sp, dwarf shrubs and Sphagnum moss. Endangered species include Calla palustris, Carex limosa, C. paupercula, Diphasum alpinum, D. comlanatum, Pinguicula vulgaris, Andromeda polifolia, Antennaria dioica and Arnica montana.

FAUNA The fauna is adapted to the harsh winters with heavy snow falls and closed forest cover. Some traditionally migrate seasonally, like red deer Cervus elaphus and roe deer Capreolus capreolus. Rare and threated species incude lynx Lynx lynx, otter Lutra lutra (V), capercaillie Tetrao urogallus, hazel grouse Bonasa bonasiaJu, black grouse T. tetrix, black woodpecker Dryocopus martins, Eurasian pygmy owl Claucidium passerinum (50 pairs) and Tengmalm's owl Aegolius funercus. The eagle owl Bubo bubo, ural owl Strix uralensis and raven Corvus corax have been reintroduced.

CULTURAL HERITAGE Man only settled here at a late stage as the region was so isolated and the forest impassable. Towards the end of the fourteenth century, firewood and potash was obtained from the forest for glassworks. Logging was also carried out in the nineteenth century.

ZONING/CONSERVATION MANAGEMENT There are three strict reserves totalling 138ha with access only for research purposes; two nature reserves totalling 581ha with protection of vegetation, fauna and soils; 4,000ha where timber cutting is prohibited; 250ha enclosures and aviaries for viewing native birds and mammals; and 40ha interpretative and play areas, including a botanical garden. A general management plan was produced in 1976 and others later developed specifically for forests, wildlife management, visitor facilities and research, renewed in 1982. A new general plan was to supercede the first. Visitor pressure is moderated by a system of zoning to restrict access to nature reserve areas and concentrated visitor interest in intensive use areas. Enclosures and aviaries have been set up in the latter to make the forest fauna easier to view. Nine wolves which accidentally escaped from such an enclosure in 1976 were followed up under WWF Pronect 1395 to assess the feasability of wolf re-introduction. It concluded that while the habitat was suitable, there was too much opposition from a hunting minority to make this possible.

STAFF Total staff of 173 of which 50 are engaged in research

LOCAL ADMINISTRATION Nationalparkverwaltung Bayerischer Wald, Freyunger Strasse 2, 8352 Grafenau, Federal Republic of Germany.

VISITOR FACILITIES The park has an interpretation programme and environmental education activities. The Visitor Centre was opened in 1982 and 200,000 visitors were registered that year. There are enclosures containing animals such as wolf, lynx, European bison and wild cat to enable visitors to observe them easily. In this area there are car parks, a snack bar and educational playground. There are several circular walks and hikes throughout the park, and several roads through it. Nearby campsites exist and there is accommodation available within 10km.

SCIENTIFIC RESEARCH AND FACILITIES Ongoing research programmes include geology, soils, vegetation, fauna, wildlife management, visitor opinions and visitor environmental impact. Potential studies include the impact of certain types of land use such as timber removal, hunting and tourism, and monitoring air and water pollution and phenological observations.

LOCAL POPULATION No information

MODIFICATION OF THE NATURAL ENVIRONMENT Large scale logging was carried out from the beginning of the 19th century and vast expanses of timber were cleared, leading to a reduction in the mixed stands which are resistant to snow and storm because they are composed of trees of different ages and sizes. The white pine has declined due to this. Reduction of natural predators, forestry methods and artificial feeding caused the deer to overgraze the vegetation and impair the natural regenerative powers of the forest. Winter feeding and shooting of deer in the park are undesirable and expensive (100,000DM in 1977), the former being a traditional practice in such areas with harsh winters. Overgrazing might be solved by the cessation of all winter feeding and concentrating culling in valleys outside the park. However, the forest is comparatively natural and the original variety of flora and fauna is very nearly intact. Even this ara has not escaped from air pollution, which has caused trees to die and polluted soils. Particularly affected is Norway spruce, the most common tree, white pine and scots pine (Bibelriether, 1984).

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Bia National Park

BIOGEOGRAPHICAL PROVINCE 3.01.01 (Guinean Rain Forest)

LEGAL PROTECTION Total within the national park (only tourism and ecological research permitted). Controlled exploitation of flora and fauna is allowed in the game production area to the south, but fauna is strictly protected at present. The park is protected under Act 43, Wild Animals Preservation Act of 1961, and Legislative Instrument 1105, 1977.

DATE ESTABLISHED 1974 as a national park of 30,600ha (Legislative Instrument 881); modified 1976 (Legislative Instrument 1084); reduced to 23,000ha in 1979 and further reduced to the present size of 7,770ha in 1980. The 22,800ha excised from the park has been established as a 'Game Production Area'. Approved as a Biosphere Reserve in 1983. First established as Bia Tributaries South Forest Reserve in 1935, demarcated between 1937 and 1939, and legally constituted a forest reserve in 1940.

GEOGRAPHICAL LOCATION In the western region, near the Ghana-Ivory Coast border, in the south-west corner of the Southern Ashanti Uplands. Approximately 240km north-west of Sekondi-Takoradi and 120km west of Kumasi. 6°32'-6°37'N, 3°02'-3°08'W.

ALTITUDE 145-230m

AREA 7,770ha (nationl park and Biosphere Reserve); contiguous to the Bia Game Production Area (22,810ha) and the proposed Bia Tawya Forest Reserve to the south and the proposed Sukusuku Forest Reserve to the west.

LAND TENURE Government

PHYSICAL FEATURES Bia lies in the south-west corner of the Southern Ashanti Uplands. Topography is undulating, and the geology mixed, with Lower Birrimian (middle Pre-Cambrian) to the east, granites to the west, and Upper Birrimian forming a north-south strip through the middle. The soils derived from the mixture are acrisols, locally classified as forest ochrosols. The park protects the headwaters of the Panabo and Sukusuku rivers which flow into the Ivory Coast, and the Tawya which is a tributary of the Bia. The climate is humid tropical, with a distinct dry season from December to March. Temperatures are estimated to vary from a maximum of 29-34°C (July/August) to a minimum of 20-22°C (February/March). Rainfall peaks are in June and October and the mean annual total is between 1500-1700mm. At 250m, means of 25°C and 1600mm are recorded.

VEGETATION In general the vegetation of the park is relatively untouched, this, together with Nini-Suhien, being perhaps the only areas in Ghana where virgin rain forest (0.6% of Ghana's original high forest) still exists. The park straddles moist evergreen and moist semi-deciduous tropical forest. The area was originally described as belonging to the Celtis-Triplochiton association of humid semi-deciduous forest, but later found to be a separate unit, dominated by species in families other than the Ulmaceae and Sterculiaceae, such as Tieghemella heckelii, Entandrophragma angolense, Strombosia glaucocense and the two palms Raphia vinifera and R. gigantea. There is a high density of valuable timber species and 627 vascular plants have been recorded, of which 169 are trees reaching heights of more than 8m in the centre of the park. Tallest emergents reach heights of about 70m. Climbers, epiphytic orchids, mosses and liverworts abound. A list of species recorded in the park was produced for the Biosphere Reserve nomination form sent to Unesco.

FAUNA All the mammalian species typical of unencroached Guinean high forest zone are found in the Bia area, including red colobus Colobus badius, western black-and-white colobus C. polykomos and olive colobus Procolobus verus (T)), diana monkey Cercopithecus diana, lesser white-nosed monkey C. petaurista, Campbell's monkey C. campbelli, mangabey Cercocebus torquatus, and chimpanzee Pan troglodytes (T). Other species include leopard Panthera pardus (T), golden cat Felis aurata, elephant Loxodonta africana cyclotis (T), giant forest hog Hylochoerus meinertzhageni, bush pig Potamochoerus porcus, bongo Tragelaphus euryceros, bushbuck T. scriptus, forest buffalo Syncerus caffer nanus, yellow-backed duiker Cephalophus sylvicultor, Maxwell's duiker C. maxwelli, bay duiker C. dorsalis, royal antelope Neotragus pygmaeus, African giant squirrel Protoxerus stangeri, Beecroft's flying squirrel Anomalurus beecrofti, long-footed rat Malacomys longipes, giant pangolin Manis gigantea (very rare in the park) and honey badger Mellivora capensis. Dry season concentrations of animals which have been observed in the centre of the area are unusual and give the reserve an added importance. The forest elephant population is one of the few viable groups existing in the eastern part of the Guineo-Congolian Forest Region. There is a diverse avifauna, including white-breasted guineafowl (E) Agelastes meleagrides as well as some forms which may be rare or of limited range, such as the Ghanaian form of the black-collared lovebird Agapornis swinderniana, Chapin's spine-tailed swift Telacanthura melanopygia and Sharpe's apalis Apalis sharpii. Bia is also the only known natural site for the newly described lizard Agama sylvanus. A list of species found in the park was sent to Unesco with the Biosphere Reserve nomination.

ZONING/CONSERVATION MANAGEMENT The areas removed from the park now constitute the Bia Game Production Area, which acts as a buffer zone to the park to the south. The core zone of the biosphere reserve occupies 300ha. The Ministry of Agriculture Forestry Division produced a working plan for Bia Group Forest Reserve in 1970. The fauna of the park is protected by rangers and technical staff carry out census work on a regular basis.

STAFF Seventy-seven personnel (two university trained)

LOCAL ADMINISTRATION The Senior Game Warden, Bia National Park, PO Box 171, Sefwi-Wiawso.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES This reserve is one of the best studied forest areas in Ghana. Research includes work on the status and rehabilitation of chimpanzee and there is currently a survey of other primates within the park (IUCN/WWF Project 1613). Inventories of species have been produced. Research is proposed in a number of fields, including assessment of changes in the structure and composition of the flora and fauna and the effects of human impact on natural ecosystems. There are two field research stations, one in the park and one in the game production area, the latter to be developed into a field centre. Only foot trails penetrate the park area with the exception of permanent transect lines for faunal surveys. Sites are ready for park headquarters (including a school for primary education and a clinic) and additional scout camps. The authorities of Ghana propose the establishment of a Bia Ecological Research and Education Centre for which international assistance is needed. A building does already exist, with 40 single rooms for junior staff and two bungalows for senior staff. There is a climatic station, at which rainfall only is currently recorded. It is to be upgraded to a full meteorological station for recording most climatic variables.

MODIFICATION OF THE NATURAL ENVIRONMENT Selective logging takes place in the game production area. It has been demonstrated that many of the economically valuable trees are important food species for forest primates. There are unconfirmed reports that large areas of the game production area have been felled. If these reports are true, they are serious as the south of the park is apparently very important for dry season water supplies to elephants. Although exploitation of fauna is allowed, it is strictly controlled at present. Many hunting licenses have now been issued and the police have tightened their control on firearms licences. However, poaching and illegal hunting within the park still continues and has considerably reduced the fauna. Evidence from reconnaissance surveys indicates that in the recent past (most probably between 1940 and 1961) there were timber exploitations in the area. Other indicators of past human disturbances are the plantations of Mitragyna stipulosa, M. ciliata, Entandrophragma angolense, Tectona grandis, Terminalia ivorensis, T. superba and Cedrela odorata found in various parts of the park. The only settlements in the park are the research centre units. Tourism and recreation has also had some impact on the park.

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Gorge of Samaria National Park

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED 6 November 1962 under governmental jurisdiction (Greek Forest Service) P.D. 742/8/11/1962 and 102/15.2.1964; and area extending to the coast was accepted as a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION Western Crete, in the White Mountains (Lefka Ori), 45km south of Chania. 35°13'-35°18'N, 23°54'-23°58'E.

ALTITUDE 0-2,116m

AREA 4,840ha

LAND TENURE Government ownership 80%, local community ownership 20%

PHYSICAL FEATURES The scenery makes this one of the most spectacular national parks in Greece and it won the European Diploma of the Council of Europe in 1979. The park comprises the catchment of the river Tarreo which unlike its tributaries, flows all year but fluctuates seasonally. These streams and the river flow through spectacular gorges, the main one being as narrow as 3.5m wide but towering 600m with walls of grey and red rock. The upper parts of the gorge are composed of Triassic limestone and dolomite while the lower parts consist of Jurassic limestone with layers of schist, differentially eroded by the river to form waterfalls and pools. The mean annual temperature at an altitude of 62m is 18°C and annual precipitation 665mm.

VEGETATION The park has a diverse flora as it is wetter than many parts of Crete. Forest and maquis cover 3,114ha, phrygana 926ha and rocky or bare areas 791ha. There are stands of high altitude Mediterranean forest containing calabrian pine Pinus brutia, funeral cypress Cupressus sempervirens var. horizontalis and cretan maple Acer orientalis. Maquis includes stands of holm oak Quercus coccifera, heath Erica arborea, juniper Juniperus oxydendrus, J. macrocarpa, Pistacia lentiscus, carob Ceratonia siliqua, wild olive Olea sativa, O. oleaster, Ebenus creticus, plane Platanus orientalis, Cretan dittany Origanum dictamus, O. microphyllum, Paeonia clusii, Grecian sage Phlomis fruticosa, P. cretica, thyme Thymus capitatis, rock rose Cistus salvaefolius and C. creticus. The 14 endemic species include Petromarula pinnata, Celsia arcturos, Linum arborum, Asperula incana, A. idaea and Verbascum spinosum.

FAUNA The gorge is famous for its population of wild goats Capra aegagrus cretica which number about 300, a relict endemic subspecies. Mammals include Cretan wild cat Felis sylvestris cretensis, badger Meles meles arcalus, beech marten Martes foina bunites, weasel Mustela numidica galinthias, dormouse Glis glis argentes, fox Vulpes vulpes and jackal Canis aureus. Birds of prey include lammergeier Gypaëtus barbatus, griffon vulture Gyps fulvus and golden eagle Aquila chrysaetos.

CULTURAL HERITAGE The Gorge of Samaria and the whole of the White Mountains have great historical significance for Cretans, as they were a mythical residence of gods and nymphs and a stronghold of Christianity during the Turkish occupation. There are five small churches, one dating back to 1397 while another called Ossia Maria gave its name to the gorge.

ZONING/CONSERVATION MANAGEMENT Core and buffer zones not yet identified

STAFF Ten forest wardens

LOCAL ADMINISTRATION Forest Service, Hania, Crete.

VISITOR FACILITIES Tourism is increasing, with over 150,000 visitors per year. Access is from the town of Hania (42km) to Xyloskalon-Omalos at the park entrance or from Chora-Sfakion to Agria Roumeli by boat only. Access within the park is by foot on the main trail only and no camping is allowed. No accommodation exists in the park but overnight accommodation is available in Agria Roumeli and there are hotels in Hania and a tourist pavilion which has limited overnight accommodation, information centre and restaurant in Omalos near the entrance. Samaria village in the park, contains two restored churches and a restored guard's house with first aid facilities. Rest places have been created at several springs.

SCIENTIFIC RESEARCH AND FACILITIES Research includes a wild goat study (Schultze-Vestrum). A management plan was evaluated by the State University of New York, supervised by the Greek Forest service, in 1978. Studies on plant and animal populations are carried out periodically by visiting scientists. Research could be carried out on the virgin stand of Cupressus sempervirens. There is accommodation for scientists in Samaria village. A trail system for botanical studies has been developed.

LOCAL POPULATION No information

MODIFICATION OF THE NATURAL ENVIRONMENT There is illegal hunting and grazing in the remote areas and danger from forest fires caused by summer visitors.

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Mount Olympus National Park

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The National Park was established on 9 June 1938 and the area accepted as a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION Near the east coast of mainland Greece about 20km south-west of Katerini. 40°02'-40°07'N, 22°18'-22°26'E.

ALTITUDE 400-2,914m

AREA 4,000ha

LAND TENURE State and local community ownership 90%, private ownership 10%

PHYSICAL FEATURES Mount Olympus is the highest mountain in Greece and the park includes its eastern slopes and peak. Most of the area of formed of Triassic and Jurassic limestone so that surface water is scarce, many streams are seasonal and soils dry. Many slopes are covered with large expanses of screes annuald temperature is 8°C and rainfall 1200mm per annum.

VEGETATION The flora is unique and diverse due to the variety of altitudes and habitats, including rocky slopes. There is 1,468ha of forest including black pine Pinus nigra, Balkan pine P. leucodermis, beech Fagus sylvatica, plane Platanus orientalis, Grecian fir Abies cephalonica and 1,672ha of alpine pasture. Mount Olympus exhibits a clearly zoned vegetation and supports one of the most species-rich floras of any mountain in Europe. The lower slopes are covered with maquis but between about 800m and 1,800m are forests of beech and black pine. Balkan pine forms the tree line which reaches 2,500m in plances and above this are high meadows. Strid (1980) reports at least 1,700 species recorded including about 20 local endemics such as Rhynchosinapis nivalis (R), Campanula oreadum, Cerastium theophrasti, Silene oligantha, S. dionysii, Achillea ambrosiaca, Centaurea litochorea, C. transiens, Alyssum handelii, Festuca olympica, Poa thessala, Genista sakellariadis, Potentilla deorum, Asperula muscosa, Melampyrum ciliatum, Carum adamovici, Ligusticum olympicum and Viola striis-notata. The area also contains Jankaea heldreichii (V) (persistent reports of collection for rock gardens), Viola delphinanthe (V) and dwarf birch Beta nana (R). Other species include Omphalodes luciliae, Centaurea incompleta, Aubrietia thessala, Erysimum olympicum, Allium heldreichii, Lilium chalcedonicum, Epipogium aphyllum, Aquilegia amaliae, Veronica thessalica and Viola delphinantha.

FAUNA Mammals include wolf Canis lupus, jackal C. aureus, fox Vulpes vulpes, hare Lepus capensis, red squirrel Sciurus vulgaris and roe deer Capreolus capreolus. Birds include golden eagle Aquila chrysaetus and many other raptors.

CULTURAL HERITAGE Mount Olympus is the legendary dwelling place of the gods, due to its height and grandeur.

ZONING/CONSERVATION MANAGEMENT Core and buffer zones have not been identified There is a management plan. In the past there has been little active protection to back up the legislation protection but most of the area is fairly inaccessible and has remained little disturbed. However, as visitor numbers are increasing annually, new regulations have been put into force.

STAFF One Forest Service warden and three seasonal staff

LOCAL ADMINISTRATION Forest Service, Katernin.

VISITOR FACILITIES Access is from the village of Litohoron at the park entrance and there is a dense network of trails and footpaths. Within the park is the abandoned monastery of Aghios Dionysios and four mountain refuges with skiing installations. There are hotels and other accommodation in Litohoron. There are a large number of visitors, notably climbers and botanists.

SCIENTIFIC RESEARCH AND FACILITIES Research has included a number of studies on flora and fauna including botanical studies by the University of Patras, University of Thessaloniki and Institutions in Denmark and Sweden. There is a meteorological station within the park at 1,200m.

LOCAL POPULATION The park itself is remote with the village of Litohoron about 7km away.

MODIFICATION OF THE NATURAL ENVIRONMENT There have been small amounts of timber extraction and grazing which still need to be excluded from a core zone. Generally, little management has been undertaken. The area is seasonally very dry and there is a fire hazard. Scientific and visitor facilities need planning and developing.

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Réserve de la Biosphere des Monts Nimba

BIOGEOGRAPHICAL PROVINCE 3.01.01 (Guinean Rain Forest)

LEGAL PROTECTION Legally protected in Guinea as réserve naturelle intégrale Monts Nimba by decree. Prospecting for minerals is allowed and permits can be acquired for sport-hunting in parts of the reserve.

DATE ESTABLISHED Strict nature reserve established by decree in 1944 in Guinea. Accepted as a Biosphere Reserve in 1980. Inscribed as a World Heritage Site in 1981.

GEOGRAPHICAL LOCATION The massif of Nimba is situated on the border between Guinea, Ivory Coast, and Liberia. Some 20km from the town of Lola and 62km from N'Zérékoré. 7°18'N, 10°35'W

ALTITUDE 450-1,752m (Mont Richard Molard)

AREA The Biosphere Reserve covers an area of 17,130ha

LAND TENURE Government

PHYSICAL FEATURES Mount Nimba is part of the 'Guinean Backbone', rising 1,000m above the even, almost flat, surrounding glacis. It forms an immense barrier, cutting across the country from the south-west to the north-east. This area is unequalled as an illustration of the theory of erosion levels. The sharp relief and striking topography of the mountains, with their grass-covered summits and precipitous slopes, is due to a bar of ore-containing quartzites. Since the end of the Primary Era, erosion through weathering has caused a gigantic sheet of this quartzite to jut out of the softer schists and granitogneiss, which form the piedmont. The softer rocks have been gradually weathered and removed. These hard iron-quartzite crusts cover the vast sub-horizontal glacis of the eastern and northern parts of the piedmont and create very poor soils, which are usually skeletal or non-existent. The soil conditions explain the belt of savanna vegetation at 500-550m around the mountains. The Nimba Mountains contain the sources of the rivers Cavally and Ya (which forms the Mani River of Liberia) and are cut up by deep, richly forested valleys. There is great topographical diversity with valleys, plateaux, rounded hilltops, rocky peaks, abrupt cliffs and bare granitic blocks, and the whole area constitutes a vast water catchment. Mean annual temperature minimum: 15.8°C, maximum: 29.7°C, and mean annual rainfall 2,849mm, occuring over 178.8 days, recorded at 543m.

VEGETATION There are three major vegetation types: 1) High altitude grassland with Loudetia kagerensis near the summit and endemics including Blaeria nimbana and Dolichos nimbaensis and woody plants such as Protea angolensis on the slopes, which are absent from the ridges. Remnants of forest at high altitudes are likely to be dominated by Mytaceae species and the ravines by the tree fern Cyathula cylindrica var. mannii. 2) Plains savanna varying according to the hardness of the soil and supporting numerous herbaceous plant communities. The savanna is broken by gallery forests which grow between 1000m-1,600m. Parinari excelsa is dominant above 1,000m, and there are abundant epiphytes. 3) Predominantly primary forest, located mainly on the foothills and in the valleys with dominant species including Triplochiton scleroxylon, Chlorophora regia, Morus mesozygia, Terminalia ivorensis, Lophira procera, Tarrietia utilis, and Mapania spp.. Drier, mid-altitude forests with trees such as Triplochiton scleroxylon, Piptadeniastrum africanum, and Parkia bicolor are found at the northern end of the Mount Nimba chain. Dry forests

are rarer than the rainforests because of agricultural pressures, and some of the dry forest species have disappeared from many areas. There are very few endemic plant species at Mount Nimba, probably because altitude is not sufficient for new tree species to have evolved. Montane endemics include a pteridophyte, Asplenium schnelli, two phanerogams, Osbeckia portersi, and Blaeria nimbana.

FAUNA More than 500 new species of fauna have been discovered in the Mount Nimba Reserve. Species diversity is exceptionally rich because of the variety of ecotones created by the presence of grasslands laced with forest. Mammals include: bushbuck Tragelaphus scriptus, Maxwell's duiker Cephalophus maxwelli and particularly black duiker Cephalophus niger, bay duiker C. dorsalis and forest buffalo Syncerus caffer nanus, bush pig Potamochoerus porcus, warthog Phacochoerus aethiopicus, scaly anteaters such as the white-bellied pangolin Manis tricuspis, pygmy hippopotamus Choeropsis liberiensis (T), leopard Panthera pardus (T), lion P. leo, golden cat Felis aurata, two-spotted palm civet Nandinia binotata, African civet Civettictis civetta, forest genet Genetta maculata, servaline genet Genetta servalina, Johnston's genet Genetta johnstoni, cane rat Thryonomys swinderianus, African clawless otter Aonyx capensis, lesser otter shrew Micropotamogale lamottei (a new genus discovered on Mount Nimba), potto Perodicticus potto, western black and white colobus Colobus polykomos, red colobus Colobus badius, diana monkey Cercopithecus diana, chimpanzee Pan troglodytes (T), and lesser bushbaby Galago senegalensis. One of the most noteworthy species is the viviparous toad Nectophrynoides occidentalis (V), which occurs in montane grasslands at 1,200-1,600m and is the only tail-less amphibian in the world that is totally viviparous. There are a number of rare and endemic bird species. Upland invertebrate species include gastropod molluscs and various types of insects belonging to the Carabidae, Gryllidae, Acrididae and the Forciculidae (beetles, grasshopper, crickets and earwigs) families, of which more than 20 are endemic to Mount Nimba. The forests contain numerous reptile and amphibian species including West African toad Bufo superciliaris and frog Cassina lamottei.

CULTURAL HERITAGE The reserve is also of archaeological interest. Hewn stone tools and chippings have been discovered in a rock shelter at Blandé at the northern end of the mountain.

ZONING/CONSERVATION MANAGEMENT The biosphere reserve in Guinea contains a core zone of 10,000ha. The reserve does not have a management plan. Awareness of the value of the area and a better degree of protection seems possible following designation of the reserve as a world heritage site.

STAFF Total of 17, with two researchers

LOCAL ADMINISTRATION In Guinea, Station Biologique des Monts Nimba, S/C INRDG, BP 561, Conakry.

VISITOR FACILITIES Tourism is prohibited within the strict nature reserve.

SCIENTIFIC RESEARCH AND FACILITIES Botanical, zoological, and geological inventories have been completed. More than 500 new species have been described or reported, including several mammals (a new genus of otter shrew), more than ten amphibians and reptiles, several fish and arthropods (notably centipedes and harvestmen), and molluscs. Research includes phytosociological studies of high altitude grasslands, primate studies, and the collection of meteorological data. Several international research workers in the fields of biology, ecology, geography, primatology, and meteorology are interested in

this area and with appropriate facilities, scientific research in Nimba could form the basis of a tropical ecology station of international importance. There are six patrol stations in the reserve which are used to monitor various environmental parameters. The IFAN (French Institute for Black Africa) research station is at the northern tip of the mountain chain. The LAMCOOmining company set up a small research station in the Liberian area (outside the reserve) in 1964.

LOCAL POPULATION There has probably never been any village on the actual mountains, but there are ten villages in the immediate vicinity of Nimba with several thousand inhabitants, mainly growing crops.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has similar problems to Taï National Park (Ivory Coast). There is poaching and some cultivation. The main threat is from the massive iron-ore mining activities in the southern part of the chain in Liberia. About 6,000ha are in danger. Roads, wells, and mineshafts have been built and workshops and townships established in what has been a strict nature reserve since 1944. Hundreds of square metres of soil have been removed over large areas and, as a result, many streams for miles around are fouled with heavy metal run-off, particularly ferruginous rock debris.

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Réserve de la biosphère du Massif du Ziama

BIOGEOGRAPHICAL PROVINCE 3.01.01 (Guinean Rain Forest)

LEGAL PROTECTION Protected under decree No. 1168/AE of 25 June 1932, No. 3272/SE/F of 12 September 1943, and No. 1215/SE/F of 20 April 1945 (extending the protected area). Core area is strictly protected and hunting is prohibited in the surrounding buffer zone.

DATE ESTABLISHED Accepted as a Biosphere Reserve in November 1980.

GEOGRAPHICAL LOCATION In the Sérédou Arrondissement, Macenta Administrative Region, 40km from the town of Macenta and 100km from N'Zérékoré. The western boundary is formed by the Liberian frontier, and eastern boundary by the Macenta-N'Zérékoré road. Approximately centred 8°20'N, 9°20'W.

ALTITUDE 500-1,387m

AREA 116,170ha

LAND TENURE Government

PHYSICAL FEATURES The reserve lies in an area of mountainous landscape characterised by rugged relief with notable features including the mountain passes of Zombromai and Voroa and a magnificent uninterrupted view from Sérédou of valleys, plateaux, rounded ridges, rocky peaks, sheer cliffs, and bare granite outcrops. Mean annual temperature is 23°C and mean annual rainfall 2,849mm.

VEGETATION The four principal vegetation types are: primary mountain forest; secondary mountain forest; secondary forest in the valleys, plains and swamps; and savanna on lateritic outcrops of the elephant grass-covered plateaux. Principal species are azobé Lophira procera, fraké Terminalia altissima, framiré Terminalia ivorensis, samba Triplochiton scleroxylon, iroko Chlorophora excelsa, raphia Raphia, rattan palm, and umbrella tree.

FAUNA Fauna are reported to include elephant Loxodonta africana (T), various species of antelope and monkey, fish Silurus spp., and a rich insect fauna.

ZONING/CONSERVATION MANAGEMENT Core zone 60,000ha and buffer zone

STAFF Total of 129, mainly engaged in administration and control

LOCAL ADMINISTRATION Centre Forestier de Sérédou, S/C INRDG, BP 561, Conakry.

SCIENTIFIC RESEARCH AND FACILITIES There is monitoring of climate, vegetation, soils, and hydrology. Some experimental plots exist. Further research could be carried out on botany, tree associations, and wood-working technology. The Faculty of Sylviculture has a department within the reserve with a 3-year undergraduate course. There is also an Agronomical Research Laboratory concerned with medicinal plants and the forest station concerned with timber extraction and carpentry activities.

LOCAL POPULATION The reserve has a population of 29,000 living in 23 villages and the town of Sérédou.

MODIFICATION OF THE NATURAL ENVIRONMENT Timber extraction is permitted in the buffer zone with a forestry concession of 30,000ha containing a forestry station and chipboard factory. There is also a quinine plantation, processing station and an 8ha palm grove.

PRINCIPAL REFERENCE MATERIAL Various reports, studies and general information on file at the Direction Générale des Eaux et Fôrets (Conakry), and various reports and technical studies at the Quinine Research Centre.

Rio Platano Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 8.16.04 (Central American)

LEGAL PROTECTION Protected as "Reserva de la Biosfera Rio Platano" by decree No. 977 of 14 July 1980.

DATE ESTABLISHED 1969 as an Archaeological National Park. Accepted in July 1980 as a Biosphere Reserve and December 1982 as a World Heritage Site.

GEOGRAPHICAL LOCATION A north-south belt of approximately 15 x 150km situated in the departments of Gracias Adios, Colon and Olancho and partly in the isolated Mosquitia region - one of the largest contiguous expanses of wildland in Central America. It borders the Caribbean in the north. No road system - access by water or air. 15°50'N, 84°30'-85°30'W.

ALTITUDE 0-1,326m (Punta Piedra)

AREA 500,000ha. 350,000ha constitute Biosphere Reserve proper; 150,000ha constitute a buffer zone.

LAND TENURE State-owned, although there are plots of privately-owned land within the reserve.

PHYSICAL FEATURES The reserve protects virtually the entire watershed of the 100km long Platano River, as well as major portions of the Paulaya, Guampu and Sicre Rivers. These three waterways and the Caribbean form the boundaries of the reserve. Topographic relief falls into two broad categories: the rugged mountainous headwaters region which encompasses almost 75% of the reserve, flanked by the Platano River and rising to Punta Piedra at 1,326m, and the coastal plains. The mountainous area has remarkable rock formations (eg. Dama Peak) and a waterfall of 500m. The coastal area is flat or undulating with a number of lagoons such as Ibans and Cartina and grasslands subject to winter flooding. These lowlands extend inward from just a few kilometres to more than 40 kilometres. In the littoral zone of the reserve, this flat belt reaches its innermost penetration near Baltiltuk, some 35km up river from the sea. At other points these plains are less than 10kms in width. The river basin drains an area of some 130,000ha and meanders considerably in the lowland region, marooning several ox-bow lakes. Natural levees have built up along much of this stretch and are preferred terrain for small agricultural plots. The upper two thirds of the river course is through mountainous terrain. Part of the river is subterranean below huge basalt rocks. The climate is hot and humid. Annual precipitation 2000-3000mm with an average annual temperature of 26.6°C.

VEGETATION This is the largest surviving area of virgin tropical rainforest in Honduras and topographical disparity has resulted in a wild array of ecosystem types. The two dominant life zones are Humid Tropical Forest and Very Humid Subtropical Forest (Holdridge). The majority of the reserve lies within Humid Tropical Forest (over 90%). Vegetation types include pine savannahs with Pinus caribbea the principal tree, mangroves Rhizophora mangle, and swamp forest fringing the coastal lagoons and hardwood gallery forest along the Platano river and major tributaries. The greatest portion of the watershed is blanketed by mature broadleaf forest. The flora is not well known, but some 300 species have been identified including: gallery forest: species of Inga, Cecropia, and Heliconia, and Pachira aquatica; lacustrine ecosystems: Coccolaba uvifera, Rhizophora mangle, Languncularia recemosa and Cocos nucifera; savannah and coastal plains: Pinus caribea, yagua palm

Paurotis spp. and grasses; degraded secondary forest: Salix humboltiana, species of Bambusa and Inga, and Ceiba pentandra; climax forest: Chusquea spp., Pinus caribea, Geonoma, Chamaedorea, Vochysia, Virola koschnii, Calophyllum brasiliensis and Apeiba spp.; and high mountain areas: mahogany Swietenia macrophylla, Tabebuia spp., cedar Cedrela odorata, Bursera simaruba and Chisia salvinii. Other common species include Lonchocarpus, Albizzia carbonaria, bamboo and Chamaldorea.

FAUNA Thirty-nine species of mammals, 377 species of birds and 126 of reptiles and amphibians have been recorded. Threatened species include giant anteater Myrmecophaga tridactyla (V), Baird's tapir Tapirus bairdii (V), jaguar Panthera onca (V), ocelot Felis pardalis (V), puma F. concolor, margay F. wiedii (V), jaguarondi F. yaguaroundi (I), Central American otter Lutra longicaudis, manatee Trichechus manatus (V), American crocodile Crocodylus acutus (E), brown caiman Caiman crocodilus, red brocket deer Mazama americana, harpy eagle Harpia harpyia (R), scarlet macaw Ara macao, green macaw A. ambigua, military macaw A. militaris, king vulture Sarcoramphus papa, great curassow Crax rubra and crested guan Penelope purpurescens. Fish include cuyamel Joturus pichardi.

CULTURAL HERITAGE The site of Ciudad Blanca within the protected area constitutes one of the most important archaeological sites of Mayan civilisation. Archaeological remains include the Piedras Pintadas petroglyphs on the bed of the Platano River, believed to belong to an unknown pre-Columbian culture. Another important feature is the so called "White City", which is believed to have been the centre of an unknown pre-Colombian culture

ZONING/CONSERVATION MANAGEMENT 150,000ha buffer zone which includes the Panlaya River basin in the NW, Lagarto River basin in the S-SW and Sicre River basin in the SE. Also natural and cultural zones. A management and development plan was completed in 1980 to strictly preserve natural features in the region and implement effective and specific measures to conserve the cultural features with the support of the local population. Working plans include conservation infrastructures at Palacio (NW), Aldea las Marais (S), Las Marais and Kuri. Projects for 1983/4 include community development programmes, construction of transport canals between lagoons and protective measures against illegal mineral exploitation.

STAFF Director General of Renewable Natural Resources, two game guards and two visiting biologists. Staff due to be increased soon.

LOCAL ADMINISTRATION Direccion General de Recursos Naturales,Renovables, Renare, Tegucigalpa D.C.

SCIENTIFIC RESEARCH AND FACILITIES Basic inventories of the natural and cultural resources and more detailed anthropological and archaeological surveys have been completed. The legend of a white city (Ciudad Blanca) has been neither confirmed nor refuted. There is an information/education centre at Las Maraisar and a small research station. There is also an information/education programme. Accommodation is available for visiting scientists.

LOCAL POPULATION There are 1,800-2,000 inhabitants in the area with the main villages situated in the coastal region and upstream. The reserve contains a small group of Paya Indians (17) and 1,500 Miskito Indians, both of ethnographic importance.

MODIFICATION OF THE NATURAL ENVIRONMENT The region is threatened by three developments. The most immediate problem is posed by the plan to resettle about 4000 Nicaraguan Miskito Indians on the border of the reserve's buffer zone. It is feared that the Meskitos, who are subsistence agriculturalists and hunters, will rapidly spill over into the reserve. Colonisation is also approaching the reserve's south-western borders. A potential plan to construct a military road through an isolated section of the buffer zone has been temporarily stalled due to international pressure. Other threats include illegal hunting, plundering of archaeological remains and potential timber exploitation. There are plans to build a road from the Department of Olancho to the political centre of Puerto Lempira, which will pass close to the southern border of the reserve and increase the danger of unplanned, detrimental colonisation.

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Biosphere Reserve of Aggtelek

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Decree No. 811978 of OKTH (National Authority for Environment Protection and Nature Conservation)

DATE ESTABLISHED Created as the Budai Landscape Protection Area in 1978 and subsequently declared a national park on 1 January 1985. Biosphere reserve status approved in 1979.

GEOGRAPHICAL LOCATION Situated in two sections (the Aggtelek-Josvafo and the Szalonnai-Karszt) in north Hungary, 40km north of Miskole on the Czechoslovakian border which forms the western and northern boundaries of the reserve and separating it from the Slovak Karst Biosphere Reserve (created in 1977). 48°30'N, 20°36'E.

ALTITUDE 150-600m

AREA Biosphere Reserve 19,247ha. The Budai Landscape Protection Area was 19,708ha and the National Park is 19,821ha.

LAND TENURE A mixture of ownerships with 65% state land; 32% cooperative property; 3% private ownership.

PHYSICAL FEATURES The site belonging geographically to the southern limstone claim of the northern Carpathian mountains is a very varied but characteristic karst landscape with features regarded as being among the best in Europe, with unique superficial karstic phenomena, karrenfelds and cave formations. It is the most completely explored karst area in Europe, with a system of underground caves, including the Jovafo-Aggtelek-Domitsa system which is the third largest in the world at 23km length, a cavern capable of holding 1,000 people, a 13m long stalactite, two streams and the Domica cave which extends 8km into Czechoslovakia. The cave temperatures remain a constant 12°C.

VEGETATION The reserve, at its northern edge, belongs to the Tornense flora district of the Pannonian flora sector, bordering directly on the Scepusiense and Cassovicum flora districts of the Carpathian flora sector. Its characteristic plant communities are:- oak and beech woods: Melitti-Fagetum, Querco petreae-Carpinetum, Tilio-Fraxinetum, Ceraso mahaleb-Quercetum pubescentis. Rocky grasslands: Asplenio ruta-murariae-Melicetum ciliatae, Festucetum pallentis subcarpaticum, Diantho-Seslerietum jeuflerianae, Pulsatillo-Festucetum rupicolae. Secondary communities consisting of juniper: Callunetum, Festuco ovinae-Nardetum. Characteristic species are: Sesleria heufleriana, Onosma tornense, Alyssum ,ontaun subsp. brymii, Dracocephalum austriacum, Pulsatilla slavica, Jurinea mollis subsp. macroclathia, Astragalus vesicarius subsp. labidus, Carex brevicollis, Thalictrum foetidum, Erythronium dens-canis.

FAUNA Records of brown bear Ursus arctos in the 1930s and presently red deer Cervus elaphus, roe deer Capreolus capreolus and wild boar Sus scrofa and wild cat Felis catus. The insect and cave fauna are particularly rich and interesting, the latter having more than 300 species. The fauna has very varied geographic affinities, sub-Mediterranean, Carpathian and continental. Among the insects Saga pedo is a post-glacial relic of the steppe, Fuxoa birivia is a xeromontane species and Apamea rubrirena is of the Siberian fauna. Duvalis hungariens and Koenenia vagvoelgyii are notable cave species, the latter a Tertiary relic. Breeding birds species include: Ciconia nigra, Aquila heliaca, Bubo bubo and Emberiza cia.

CULTURAL HERITAGE There are some ruins and historical monuments in the area and there is evidence that the cave system was used by primitive man during the Neolithic and Iron Ages.

ZONING/CONSERVATION MANAGEMENT Two areas, of 150ha and 80ha, have been distinguished as core areas; they are surrounded by strictly protected zones. A sanctuary area was designated in the 1930s specifically for bear, deer and wild boar. The reserve is managed by the OKTH (Orszagos Kornyezet-es Termeszetvedelmi Hivatal) with the aim of ecosystem maintenance and prohibiting human activities in the cave areas, the active management of meadwos and steppe-like grasslands to maintain the plant species diversity and the continuation of traditional land-use practises. Recent ecological surveys have mapped the major habitats and their characteristics. Tourism management is aimed at encouraging year-round use, as at present there is a distinct summer peak with 300,000 visitors annually.

STAFF Conservation - nine; four-five university staff engaged in research

LOCAL ADMINISTRATION Aggteleki Nemzeti Park Igazgatosaga, Aggtelek 3759.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Aggtelek karst being the most completely explored karst area in Europe lends itself particularly well to become a model area to demonostrate interactive relations of various geological and hydrogeographical phenomena and the reserve hosts organized field courses and camps for professionals and for students. At present there are some fauna investigations in progress. Publication of a comprehensive work is expected by 1981.

LOCAL POPULATION Within the protected areas there are two villages. Aggtelek and Josvafo with about 1,500 inhabitants.

MODIFICATION OF THE NATURAL ENVIRONMENT In its natural state, the area was covered with forest communities, but the area has become barren and karstic because of timber extraction, grazing and farming and the consequent soil erosion. After the forests had been cleared, the areas lying on gentle slopes were used for arable farming and pasturing. The core zones are free from man-made structures but in the surrounding areas there are some buildings used in connection with forestry and hunting. The level of economic activity is low with some agriculture, wood and charcoal production and most local people are engaged in the service industry. Tourism focuses on the villages Aggtelek and Josvafö, and above all on the area and caves within the confines of the villages. The so-called "blue tour path", traversing the whole of Hungary, crosses the area and is used by hikers.

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Hortobagy National Park

BIOGEOGRAPHICAL PROVINCE 2.12.05 (Pannonian)

LEGAL PROTECTION Decree 1850/1972 of OKTH (National Authority for Environmental Protection and Nature Conservation) dealing with Hortobagy National Park states the need to improve the characteristic values of nature in the puszta, to preserve the peculiar landscape of the plains, the fauna and flora of Hortobagy, and to safeguard the breeding and migrating avifauna of the area.

DATE ESTABLISHED 1 January 1973 as a National Park; May 1979 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Eastern central Hungary some 80km north-east of Szolnak, 40km west of Debrecen, and 25km south-east of the Tisza valley. 47°25'-47°15'N, 20°54'-21°21'E.

ALTITUDE 86-98m

AREA 52,000ha

LAND TENURE 53% state property, 47% cooperative property.

PHYSICAL FEATURES The site extends over a vast, salt-filled expanse covered with large marshes along the flood-plains of ancient rivers whose salt bottoms have scattered staggered holes and depressions or dips. This salt desert is unique in Europe with an almost totally flat characteristic puszta landscape, which is also the largest 'secondary' steppe in Europe. The control of rivers and drainage of the marshes started 200 years ago, leading to the formation of the characterisic solonetz soils. The most striking superficial formations are the tumuli, the so-called Kuman hills, which average between 3-10m in height, some reaching 20m, and 50-60m in diameter. Most are man-made formations but there are a few hillocks of natural origin and some relics of sand-banks similar to the tumuli, shaped by wind and erosion. There are also eroded relics of loess-ridges near Hajduhat, sand-banks alongside the river Tisza and wide marshes in the original river-beds and depressions. The richness of alkali microforms is striking. Amidst the dry pastures abounding in native soda, there are some shallow marshes, seasonal salt marshes and streamlets, alkali low grounds and some other forms characteristic of sodic soils like small ledges of some centimetres in height rising above the ground level, which lend variety to the surface. In past centuries this salt desert (puszta), unique in Europe, was the scene of a semi-nomadic shepherding practised by the inhabitants of that time, contributing by grazing and its pastoral structures to form today's scenery of the puszta. The site lies in the most arid region of the Hungarian lowlands with the average rainfall only 200-300mm, the temperature high, and only one-ten windless days in the year and whirlwinds are frequent.

VEGETATION Hortobagy belongs to the flora-district (Criscicum) of the floristic region of the Great Plain (Eupannonicum). The vegetation consists mainly of species that are widely distributed in the Eurasian temperate zone, but a great number of Pontian and Pont-Mediterranean species are also present. The different management of water supplies, have given rise to a mosaic-like pattern of plant communities growing either in the marshes or on the sodic soil of the puszta. Hortobagy contains all the types of vegetation characteristic of the region: plants of relict loess ridges, relict flora of sodic areas that developed in earlier geological times, species of secondary

sodification, and survivors of the ancient marshes and wooded areas. Vegetation is closely associated with soil conditions. The most important plant communities are nearly all associations of the Hydrocharietalia, Potamion and Nymphaeion; different forms of Scirpo-Phragmitetum, the most important association of Bolboschoenion maritimi continentale; several associations of Glycerio-Sparganion (Puccinellietum limosae, Pholiuro-Plantaginetum tenuiflorae, Camphorosmetum ammuae; Agrosti-Eleochariti-Alopecuretum geniculati, Agrosti-Beckmennietum); association of Festucion pseudovinae (Salvio-Festucetum rupicolae); Salicion triandrae; Fraxino pannonicae-Ulmetum; Festuco pseudovinae-Quercetum roboris. Noteworthy endemic species are: Aster tripolium subsp. pannonica, Suaeda pannonica, Plantago schwarzenbergiana. Prevalent plant species of the sodic soils are: Plantago maritima, Matricaria chamomilla, Cerastium dubium, Hordeum hystrix, Puccinellia limosa, Plantago tenuiflora, Festuca pseudovina, Trifolium angulatum, Limonium gmelini, Artemisia maritima, Scorzonera cana, Cirsium furiens, Calatella punctata, Armoracia macrocarpa, Achillea asplensifolia. Characteristic plants in the purzta hollows include: Agropyron cristatum, Stipa capillata, Andropogon ischaemum, Festuca rupicola, Thalictrum minus, Centaurea solstitialis, Phlomis tuberosa.

FAUNA There is a very rich insect fauna paralleling the varied vegetation, especially of Orthoptera but also including all the puszta species of Libellula which occur here as well as 14 species of Leptodividae and Kolonidae. There are nearly 300 species of bird, 140 nesting. Noteworthy species are: collared pratincole Glareola pratincola, kentish plover Charadrius alexandrina, stone curlew Burhinus oedicnemus, strong population of 200 great bustards Otis tarda, baillons carke Porzana pusilla, white-winged black tern Chlidonias leucoptera, whiskered tern Chlidonias hybrida, moustached warbler Luscinia melanopogon, bluethroat L. scecica, great white heron Egretta alba, little egret Egretta garzetta, squacco heron Ardeola ralloides, night heron Nycticorax nycticorax, red-footed falcon Falco vespertinus, black-winged stilt Himantopus himantopus, avocet Recurvirostra avosetta, spoonbill Platalea leucordia, red-necked grebe Podiceps griseigna, short-toed owl Asio flammeus, aquatic warbler Acrocephalus paludicola, bearded tit Panurus biarmicus. Hortobagy National Park is one of the most important areas in Europe for migrating and wintering birds. During migration geese, numbering more than 10,000, white-fronted geese Anser albifrons, bean geese A. fabalis, lesser-white fronted geese A. orythropus and 100,000 ducks mallard Anas platyrhynchos, teal A. crecca together with several hundreds of black stork Ciconia nigra and upto 5,000 crane Grus grus, are present. Several species of the rare birds of prey such as imperial eagle Aquila heliaca, golden eagle A. chrysaetos, saker falcon Falco cherrug, peregrine falcon Falco peregrinus, short-toed eagle Circaetus gallicus, also pass through Hortobagy, and white-tailed eagle Haliaetus albicila, about 25 of which regularly overwinter. A number of ancient Hungarian domestic animals are preserved, such as grey cattle (Bos primigenius f. domestica) and Hortobagy sheep, and a Hungarian subspecies of sheep (Ovis strepticeros hortobagyiensis). Notable mammals are otter Lutra lutra, steppe polecat Mustela eversmanni and stoat M. erminea.

CULTURAL HERITAGE In ancient times, the area was an immense grazing land for cattle of nomadic herders but now the seasonal pastoral population (May-October) is small and decreasing as is the semi-nomadic sheep herding. On the purzta, herdsmens huts and buildings associated with pastoral life and ancient Hungarian domestic species are present.

ZONING/CONSERVATION MANAGEMENT The biosphere reserve occupies the same area as the national park whilst 15,000ha of the site was declared a Ramsar site in 1979. There are a number of small core areas from 15 to 200ha, representing

the most important habitats. These are little affected by human activity; no habitations or technical installations are near them, but extensive animal grazing is an integral part of their habitat maintenance. They are buffered from more intensive use. Entrance to strictly protected areas is prohibited. Extensive animal grazing is integral to the area but 30,000ha are free from irrigation and pesticide use.

STAFF Thirty-seven (18 assigned to protection; 19 to management and maintenance).

LOCAL ADMINISTRATION National Authority for Environment Protection and Nature Conservation (OKTH), Management of Hortobagy National Park, Debrecen, Böszörményu ut 138,.

VISITOR FACILITIES Visitors have free admission to most parts of the area except for strictly protected conservation areas. There is organised tourism within the national park, but there are no accommodation facilities for visitors these being available outside the park, mainly in the town of Debrecen situated 40 km away. The natural attractions of Hortobagy, its flora and fauna as well as the relics associated with semi-nomadic shepherding, are displayed in three museums.

SCIENTIFIC RESEARCH AND FACILITIES Research work is carried out by the Hungarian Academy of Sciences, the Museum of Natural Science, and in the pedological, botanical and zoological research departments of several universities. Since 1955 there have been studies of the synecology of the fauna, flora and soils, including using Margita Wood as an International Biological Programme model area. Research is being carried out on the ecology of pools, alkali low grounds, salt steppes, nesting bird communities, trace elements and man-made water bodies. Regular study of breeding and migratory birds is done by the specialized staff of the Ornithological Institute with approval of the National Park Board of Directors.

MODIFICATION OF THE NATURAL ENVIRONMENT 2,200ha are farmed; 38,200ha are alkali pastures, 30,000ha of which are free of irrigation and the use of pesticides; 800ha managed woodland; 2,500ha reed-beds and 1,000ha mowing meadows. There are some structures such as roads, canals, power lines, and 1,000ha are badly affected by tourism overuse. Its earlier Bronze Age appearance was of a typical wooded steppe with marshes, but was transformed into a dry, treeless secondary steppe by human activities.

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Kiskunsag Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.12.05 (Pannonian)

LEGAL PROTECTION Protected by decree 1800/1974 OKTH (National Authority for Environment Protection and Nature Conservation).

DATE ESTABLISHED Declared a National Park in 1974 and accepted in May 1979 as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION Lies between the Danube and Tisza Rivers to the west of Kecskemét and between 25km and 93km south-south-west of Budapest consisting of six separate areas covering just over 70% of the Kiskunsag National Park. 47°12'-46°36'N, 19°04'-19°39'E.

ALTITUDE 94-127m

AREA Area of the biosphere reserve is 22,095ha. The national park consists of six independent parts, totalling 30,636ha. a) Töserdö (Tös wood), 382ha b) Kiskunsag salt desert, 11,030ha c) Kiskunsag natron lakes, 3,903ha d) Fülöphaza sand-hills, 1,665ha e) Lake Kolon at Izsak, 2,728ha f) Bocsa-Bulgac sand-hills, 10,928ha.

LAND TENURE State property 56%, co-operative property 42%, private ownership less than 1%.

PHYSICAL FEATURES The site lies in a desert-like setting of great geographic diversity. It contains numerous small salt lakes and salt marshes with large stretches of shifting torose sands, soils rich in sodium carbonate and salt pasture lands. It lies between the Danube and the Tisza rivers and is typical of the Carpathian Basin with wide plains, sand hills, salt deserts, natron lakes and small settlements. The Kiskunsag National Park includes areas that are in a natural state as nearly natural as possible and it comprises, within its six independent parts, all the characteristic superficial configurations and vegetation types of the area between the two rivers. 1) The plain along the Danube, including the salt puszta of Kiskunsag (11,030ha), and the natron lakes is a fluvial accumulation surface, a perfect plain with various types of sodic soils. During most of the Pleistocene and Holocene fluvial accretion went on continuously until the regulation of waterways at the end of the last century, leaving a smooth surface covered mainly with loose, fine-grained deposits (loam and silt, rich in carbonates). Fluvial erosion landforms, the area, are represented by former backwaters and dead channels of the Danube. There are seasonal natron lakes in impermeable surface depressions, with characteristic features of lake abrasion on their shores. The regulation of waterways has considerably transformed the water balance and, through this the soil development and the animal and plant life of the area. Areas that had

regularly been flooded before, and were sodic only locally, have now become saturated with native soda overall. Sodic soils of solonchak and solonchak-solonetz nature, with all types of salt microrelief, can be found. 2) The tableland area between the rivers Danube and Tisza, comprising the sandhills of Fülöphaza, Lake Kolon of Izsak, and Bugac, lasted to the Gübz-Mindel Pleistocene interglacial and also had a fluvial accumulation surface. Once the Danube had assumed its present base level, wind became the main agent in shaping the landform. Many of the crested dunes, rich in carbonates, are composed of loess and deposits bedded alternately. Sometimes they are more than 100m in height on the crest of the tableland but usually about 15-20m. The dunes of the sand-hill land of Fülöphaza are exceptional for the rate of deposition of carbonate mud. Recent dolomite formation under lacustrine circumstances is known from only three other places: Deep Spring Lake, California; Coorong Lagoons, South Australia; and the northern part of Lake Balhas, Soviet Union. The saline waters of the tableland may reach a pH value of 11. Except in the higher sand-hills, the water table lies near the soil surface. The climate of the area is largely uniform, temperate continental, but there are many distinct microclimates in the sand-hills which affect the distirbution of vegetation.

VEGETATION The vegetation is rich in relict, endemic Pannonian species and represents remnants of the woody-steppe region of the Great Hungarian plain with a remarkable abundance of grass species. The following areas have been chosen to include characteristic ecosystems as well as "semi-natural" and culture ecosystems such as plough-land, intensively treated meadow-land, and pastures etc. a) Töserdï (Tös Wood): This includes a flood area along the river Tisza, with open water surfaces, shrub-like willow plantations and riverine woods of poplar, alder and oak. b) Kiskunsag Salt Puszta: This perfect plain has various types of sodic soils and is a dry and alkaline desert (salt puszta) with a characteristic saline vegetation. Its characteristic plant species are: Festuca pseudovina, Camphorosma annua, Matricaria chamomilla, Hordeum hystrix, Plantago tenuiflora, P. schwarzebvergiana, Salicola soda, Suaeda maritima, Limonium gmelini subsp. hungaricum (endemic to the plain), Aster tripolium ssp. pannonicus (endemic to the plain), Puccinellia limosa. c) Kiskunsag Natron Lakes: In the wider depressions of the salt puszta there are some shallow natron lakes, the level of which depends on rainfall. Most of the lakes completely dry out during dry summers. Amidst the natron lakes there are meadows and sodic pastures with vegetation identical to that of the Kiskunsag Salt Puszta. d) Fülöphaza Sand-Hills: The tableland between the rivers Danube and Tisza is characterized by wind-swept sand-hills. In some parts of these areas the wind structural surfaces are still observable. On a small area some are up to 15-20m in height. The only aquatic habitat are four small natron lakes without outlets which are rain fed and which saturate the surrounding soil with soda. From the rainwater running together into depressions caused by deflation there emerged four smaller natron lakes without outlet, and the soil in the vicinity of the lakes became saturated with native soda to a lesser extent. Species include: Festuca vaginata, F. wagneri (endemic of the plain), Astragalus varius, Secale silvestre, Centaurea arenaria (with endemic subspecies of the plain), C. sadleriana (Pannonian endemic), Sedum hillebrandtii (Pannonian endemic), Helianthemum ovatum, Fumaria procumbens, Echinops ruthenicus, Stipa sabulosa, Dianthus serotinus (Pannonian endemic), D. pontederae (Pannonian endemic), D. diutinus, Linum hirstutum subsp. glabrescens (Pannonian endemic), Ephedra distachya, Colchicum arenarium (endemic of the plain), Thalaspi jankae (Pannonian endemic), and Juniperus communis. e) Lake Kolon at Izsak: Lake Kolon and its surrounding consist of a wide shallow basin hollowed out by the wind, and a few open water surfaces as well as reeds. It is a typical and fine example of an internal drainage area permanently covered by water with a

strong annual fluctuation, and contains the nearly complete developmental succession of marsh plant communities. Caricetum elata and Salix cinerea replace the thick reeds at the edges. The lakes in the area are bordered by fen meadows, marsh fields and wet (humid) grasslands. This area is characterized by the following plant species: Phragmites communis, Carex elata, Angelica silvestris, Sanguisorba officinalis, Lychnis flos-coculi, Succisia pratensis, Nymphaea alba. Noteworthy species include Ranunculus lingua, Cladium mariscus, Hottonia palustris, Chrysanthemum serotinum, Iris sibirica, I. spuria, Dianthus superbus, Senecio paludoisus, Gentiana pneumonanthe, Leucojum aestivum and more than ten orchid species. The remarkable abundance in various kinds of grasses adds to the value of the fen meadows and hayfields, making them valuable genetic reserves. f) Bocsa-Bugac Sand-Hills: The surface is varied but covered with sand-hills for the most part, with amidst them wider depressions, shallow natron lakes and meadows. North-east of the sand-hills of Bugac and sharply separated from them lies a sand-puszta. A successional development of vegetation is present from windswept sand-hills to woods. According to the stage of succession, lichens, mosses, and one-year sward of Brometum tectorum secaletosum, Festucetum vaginatae danubale, Festucetum vaginatae juniperetosum, Junipero populetum alnae is present. In the transition zone between sand-puszta and sand-hills there are groves of water willow (Salix cinerea) and fenwoods of alder and ash (Fraxinus pannonicus alnetum). Characteristic species include: Astragalus excapus, Linum hirsutum ssp. glabrescens, Euphorvia sefuieriana, Gentiana pneumonanthe, Alcanna tinctoria, Onosma arenaria, Helianthemum ovatum, Fumana procumbens, Dinanthus pontederae, Colchicum arenarium, Stipa capillata, Iris humilis, Carex liparicarpos.

FAUNA 1) Puszta of Kiskunsag and Natron Lakes in Kiskunsag. Among the invertebrates of the sodic puszta the following species are worth mentioning: Dorcadion fulvum subsp. cervae (endemic species of the puszta) and Helicella hungarica living in the greenswards of Festuca pseudovina. The breeding and migratory bird species are equally notable with skylark Alauda arvensis and lapwing Vanellus vanellus, breeding in large numbers, being the principal nesting species. In addition there are: black-tailed godwit Limosa limosa, redshank Tringa totanus, avocet Recurvirostra avosetta, collared pratincole Glareola pratincola, tawny pipit Anthus campestris, great white egret Egretta alba, little egret E. garzetta, night heron Nycticorax nycticorax and stone curlew Burhinus oedicnemus. But the most important species of the area is great bustard Otis tarda, which nests also in cultivated fields both in the reserve and outside it. The area is an important feeding and resting place for flocks of white-fronted geese Anser albifrons, bean geese A. fabalis and gold plover Fluvialis apricaria. Among the mammals wood mouse Sylvaemus sylvaticus is common, while the infrequent southern birch mouse Sicista subtilis a steppe species is of outstanding importance. There are some 80 nesting species and a total of more than 200 have been recorded in the area. The birds breed either on the open-water lakes (Kelemen-szék, Zab szék, Pipas-rét) or on lakes already overgrown with reeds (Fehér-szék, Kis-rét). Species include kentish plover Charadrius alexandrinus, avocet Recurvirostra avosetta, black-winged stilt Himantopus himantopus, great-white heron Egretta alba, purple heron Ardea purpurea, spoonbill Platalea leucordia, bittern Botaurus stellaris, grey-lag geese Anser anser and baillons crake Porzana pusilla. 2) Sand-hill Land of Fülöphaza, and Bugac. The invertebrate fauna and the zooplankton of the natron lakes, lying east of the sand-hills of Fülöphaza, are unique in Europe. The invertebrate fauna is related to some extent to that of coastal brackish waters and provides food for nesting birds such as avocet Recurvirostra avosetta, black-tailed godwit Limosa limosa and redshank Tringa totanus and grey-lag goose Anser anser. The most characteristic bird species are stone curlew Burhinus oedicnemus and tawny

pipit Anthus campestris and roller Coracias garrulus. The invertebrate fauna is important above all in the areas lying on the confines of Bugac. Some characteristic species are: Acrida hungarica, Acrotylus longipes, Acanthaclisis occitanica, Batazonellus lacerticida. Among reptiles Vipera ursnii rakosiensis, an endemic subspecies in the Carpathian Basin, and Lacerta taurica are of outstanding importance. 3) Lake Kolon of Izsak. The invertebrate fauna of the reeds, fen woods and fen meadows is unusually rich. Rare paludal fish species include: Umbra krameri and Misgurnis fossilis; and ten amphibia, among them: Rana arvalis, Triturus vulgaris and T. cristatus. In the small area of Lake Kolon all the eight heron species of central Europe and spoonbill Platalea leucorodia nest regularly. Noteworthy mammals are: common shrew Sorex araneus, harvest mouse Micromys minutus, ground vole Arvicola terrestris, weasel Mustela nivalis and stoat Mustela erminea.

CULTURAL HERITAGE There are Skanzen farmlands and one museum.

ZONING/CONSERVATION MANAGEMENT There are 13 small core areas, totalling 2,280ha, surrounded by internal and external protected zones. An area of 4,000ha has been declared a Ramsar site (1979). The core areas are free of disturbance and elsewhere the arable lands, the meadows and pastures are managed in accordance with conservation interests. The main aim of the park is given as the management and preservation of the natural values of the area and adapting it to tourism. The impact of human activity on the environment is much in evidence and the traditional way of life is preserved in Skanzen farmsteads. There is a reintroduction programme for the white-headed duck Oxyura leucocephala using stock from Slimbridge.

STAFF Board of Directors of Kiskunsag National Park, 20 persons strong

LOCAL ADMINISTRATION National Authority for Environment Protection and Nature Conservation (OKTH), Management of Kiskunsag National Park, 6001 Kecskemét, Liszt Ferenc u 19.

VISITOR FACILITIES There is a considerable amount of organised tourism. Visitors have free admission to most of the area except for strictly protected conservation areas. A most important area for tourism is: Töserdö and Lugac-puszta, where pastoral structures and species of ancient Hungarian domestic animals can be seen and the museum exhibiting relics of pastoral life.

SCIENTIFIC RESEARCH AND FACILITIES Research work in the national park is carried out by the Hungarian Academy of Sciences, the Museum of Natural Science and in the research departments of several universities. There are three monitoring stations in operation in accordance with the programme developed by the Central Board for the Protection of Nature and the Environment. Most of the measurements are automated and made on a weekly basis. The parameter levels monitored are sulphur dioxide, nitrogen peroxide, carbon monoxide, carbon dioxide, dust, precipitation, air temperature, relative humidity, atmospheric pressure, wind direction and force, evaporation and soil temperature. Findings are computer stored and periodically published. Regular study and ringing of nesting and migratory birds is done by the specialized staff of the Board of Directors of the national park. There are several buildings to accommodate researchers periodically, some look-out towers for bird observation and a ringing station to support the work of researchers.

LOCAL POPULATION The protected area is sparsely settled with both state and cooperative farms and a total population of 750.

MODIFICATION OF THE NATURAL ENVIRONMENT Land use changes may be brought about by drainage and flood control works. There is massive tourism, two main roads cross the areas, there are powerlines buried gas pipelines and canals.

PRINCIPAL REFERENCE MATERIAL

Berezik, A. (1983). Adaptability of Monitoring Systems in the Mangement of Biopshere Reserves - Experiences in Hungary. In: Conservation, science and society contributions to the First International Biosphere Reserve Congress, Minsk, Byelorussia/USSR. Unesco-UNEP. Pp. 384-388.
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Lake Fertö Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.12.05 (Pannonian)

LEGAL PROTECTION Decree No. 19/1977 of OKTH (National Authority for Environment Protection and Nature Conservation) concerning the foundation of the Nature Park Lake Fertö.

DATE ESTABLISHED Declared a Landscape Protected Area in 1975 and approved as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION Situated in the north-west of the country on the border with Austria and 3km due east of Sopron. The northern boundary of the reserve follows the Austrian-Hungarian border and divides Lake Fertö (Neusiedlersee). 47°0'N, 16°43'E.

ALTITUDE 114-261m

AREA 12,542ha. The Landscape Protection Area is 3,433ha.

LAND TENURE A mixture of state owned (68%) cooperative property (32%) and private (0.5%).

PHYSICAL FEATURES The reserve contains the southern part of Lake Fertö and surrounding dry area of young Tertiary anbd Quaternary deposits together with the small salt lakes of the Fertozug region. The lake, the third largest in Central Europe, is a characteristic lowland salt lake whose catchment area is small. The water is alkaline and rich in organic matter, but it characteristically fluctuates rapidly due it is being so shallow.

VEGETATION The Fertö region is very rich in plant species (1513 in number) and contains characteristic Pannonian salt plant communities. The reserve lies on a geobotanic border: Lake Fertö and its environs belong to the floristic regions of the north-western of the north western Hungarian plain (Arabonicum) of the lowlands (Eupannonicum) and of Hungary (Pannonicum); while the range of hills the west are a part of the Latja floristic region (Laitaicum). Characteristic plant communities of Lake Fertö include: Lemno-Utricularietum, Myriopyllo-Potametum, Parvipotameto-Zannichellietun potamogetosum pectinati, Najadetum arinae, dominated by Potamogeton pectinatus

subsp. balatonicus and Najas marina respectively. Of special importance is the subtropical Mediterranean freshwater rush Schoenoplectus litoralis. Plant communities encircling the open water form a zone in the following order: Scirpo-Phragmitetum with stands of Schoenoplectus lacustris, Typha angustifolia and T. latifolia, Bolboschoenetum maritima continentale; Magnocaricion elatae, containing the interesting association Schoenoplecto americano-Juncetum maritima; Caricetum gracilis, Caricetum acutiformis-ripariae and Cancetum distichae which are important due to their presence in masses. The high sedge communities are followed by the communities of Junco-Molinietum, Deschampsietum caespitosae and Carici-Alopecuretum, containing a native plant Cirsium brachycephalum. The halophytic vegetation is represented by 17 salt plant communities, the most important of which are: Achille-Festucetum pseudovinae (with Aster tripolium subsp. pannonicum), Puccinellietum limosae, Camphrosmetum annuae and Scorzonero parviflorae-Juncetum gerardii. In the areas saturated with natural soda, there are many halophile succulents of Turan-Caspian origin, such as Salsola soda, Suaeda maritima subsp. pannonica and Salicornia species. Characteristic is Marticaria chamomilla subsp bayeri. In the wood of Szarhalom, Szarhalmi erdö Astragalus sulcatus and Rhamnus saxatilis are present which are found only in Hungary. Two important plant communities are: Festucetum rupicolae caricetosum humilis and Euphorbio angulatae-Quercetum pubescentis. Noteworthy species in the first plant community: Pulsatilla grandis, P. nigricans, Adonis vernalis, Iris pumila, Orchis ustulata, O. militaris, O. purpurea, ophrys insectifera, Anempone silvestris, Linum flavum, L. hirsutum subsp. glabrescens, Gentianella ciliata. Notable species of the tomentose oak-forest and karst scrub forest are: Euphorbia angulata, E. verrucosa, Cypripedium calceolus, Vuphthalmum salicifolium, iris graminea subsp. pseudocyperus, Cephalanthera rubra, C. damasonium, Platanthera chlorantha.

FAUNA Thirty-six species of fish are recorded from the Lake, including Misgurnus fossilis and Cobotos taenia; 35 species of crayfish, and 41 species of worms. The avifauna of Lake Fertö is of great importance, there being 260 nesting and migratory species. Among the important nesting birds are: Egretta alba, Platalea leucorodia, Ardea purpurea, Botaurus stellaris, Anser anser, Anas clypeata, Otis tarda, Luscinia svecica and Panurus biarmicus.

ZONING/CONSERVATION MANAGEMENT Three zones have been set up: core areas (about 400 ha of the most characteristic and most nearly natural communities) direct protective zone and external protective zone. In the last farming and tourism are allowed. The site abuts Neusiedlersee-Osterreichscher Teil Biosphere Reserve (25,000ha) set up in 1977.

STAFF Conservation - two; research - 15

LOCAL ADMINISTRATION OKTH Sopron Nature Conservancy Inspectorate, 9400 Sopron, Köfarago ter 9.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research is coordinated by the Fertö Region Committee of the Hungarian Academy of Sciences and there is a geophysical laboratory present. Surveys have been conducted and further research is planned on water conservation, the management and protection of the flora and fauna, and tourism. There is active cross border cooperation involving joint monitoring programmes coordinated by a Standing Committee of the Austrian and Hungarian Commissions for Unesco. Monitoring activities are focused measuring the changes that are taking place in the lake as a result of

man's actions. Other measurements are taken of the mesoclimate, microclimate and hydrological aspects. There are data available for the past 15 years.

MODIFICATION OF THE NATURAL ENVIRONMENT The core areas are almost unmodified. One settlement of 381 inhabitants is inside the reserve. There are roads, canals, and places for yachting, fishing and swimming with organized tourism on a large scale. Water levels are managed and there is controlled arable farming, vine-growing, pasturing and reed cutting. Some concern has been shown by the extensive proliferation of algae and reeds in the central areas of the lake.

PRINCIPAL REFERENCE MATERIAL

Berezik, A. (1983). Adaptability of Monitoring Systems in the Management of Biosphere Reserves-Experiences in Hungary. In: Conservation, science and society. Contributions to the First International and Biosphere Reserve Congress, Minsk, Byelorussia/USSR. Unesco-UNEP. Pp. 384-388.

Monograph of the Fertö Region in 6 volumes. A publication entitled Bibliography of the Fertö Region.

Pilis Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Designated a "Landscape Protection Area" on 31 March 1978 by legislation of the National Authority for Environment Protection and Nature Conservation. Declaration published in the official gazette "Tanacsok Közlönye" Vol XXVII No. 16.

DATE ESTABLISHED 1978. Approved as a Biosphere Reserve in November 1980.

GEOGRAPHICAL LOCATION Situated in the major bend of the River Danube in northern Hungary, bordered to the north and east by the River Danube and to the south-west by the valley of Vörösvar. Situated 30km to the north of Budapest and immediately east of Esktergom it includes the Pilis Mountains and the Mountains of Szentendre-Visegrad. 47°45'N, 18°49'E.

ALTITUDE 106-757m

AREA 23,000ha

LAND TENURE State owned

PHYSICAL FEATURES Mountainous region which geologically consists of Triassic dolomite and limestone of the Pilis Mountains in the east and south and the eruptive Miocene andesite formations of the Szentendre-Visograd mountains. Due to the difference in bedrock these adjacent mountain ranges have very different geomorphological characteristics; the Pilis Mountains have a typical riverless karst topography lacking surface waters, whilst the igneous Szentendre-Visegrad mountains are dissected by five-six large valleys with perennial rivers. The mean annual temperature is 7.1°C and mean annual precipitation is 707mm.

VEGETATION Dense oak and beech forests almost completely cover the reserve. The main plant associations are Quercetum-petraeae-cerris, Querco-petraeae-Carpinetum, Melitti-Fagetum, Corno-Quercetum, Pareiario-Aeretum,

Poetum-pannonicae (andesite steppe-meadows) and Stipetum stenophyllae. Notable species are Lunaria rediviva, Polystichum spp., Ferula/sadleriana, Cypripedium calceolus, Orchis pallens, Dactylorhiza sambucina, Centaurea mollis, Elymus asper, Achillea horanszkyi, Lamium orvala, Alyssum saxatile and Physocaulis nodosus.

FAUNA The fauna is rich in Pontian and Mediterranean elements with some Carpathian influences. Vertebrates include the very rare Pannonian lizard Ablepharus kitaibeli, Coronella austriaca, Pelobates fuscus and Salamandra salamandra. Bird species include honey buzzard Pernis apivorus, short-toed eagle Circaetus gallicus, booted eagle Hieraaetus pennatus and eagle owl Bubo bubo. Bat species include Myotis blythi and M. nattereri. Rare Orthoptera species include Isophya costata, Sago pedo, Leptophyes bosci and Stenobothrus curasius.

ZONING/CONSERVATION MANAGEMENT Several core zones totalling 1,700ha. The reserve is managed by a single state forestry authority. A general and wildlife management plan for the reserve has been prepared and the reserve is managed as a 'park forest' supporting a very small timber industry (20,000 cubic metres annually). The core areas, however, are maintained in an almsot natural state. Red deer, roe deer, mouflon and wild boar are hunted but this activity is strictly controlled. The buffer zones includes small settlements with agricultural holdings and some animal husbandry. An important function of the reserve is as a recreational area for Budapest with its population of two million, and a major management objective is to develop optimum use.

STAFF 190 staff mainly involved in administration, control and resource management of the Reserve, of which 34 are university trained.

LOCAL ADMINISTRATION Directorate of State Parkforest Pilis, Matyas Kiraly ut 4, H-2025 Visegrad.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has included aspects of, geology, hydrology and phytogeography and a full botanic and zoological inventory was carried out prior to its designation as a Protected Landscape. Studies have been conducted on the physical geography of the area and studies will be made of the entire area to evaluate the impact of tourism and other land uses on the water system and soil and woodland structure. Regular meteorological observations take place at Dobogoko meterological station where there is also a field station and accommodation for about 20 scientists. The environmental education programme arranges visits for over 10,000 school children (aged 10-14) a year.

LOCAL POPULATION They participate in the management decisions concerning local issues via appointed local municipal councils.

MODIFICATION OF THE NATURAL ENVIRONMENT The main roads are used by regular traffic and there is a network of marked tourist routes and consequently heavy use by hikers.

PRINCIPAL REFERENCE MATERIAL

Berezol, A. (1983). Adaptability of Monitoring Systems in the Management of Biosphere Reserves-Experiences in Hungary. In: Conservation, science and society. Contributions to the First International Biosphere Reserve Congress, Minsk, Byelorussia/USSR. Unesco-UNEP. Pp. 384-388.

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Cibodas Biosphere Reserve (Proposed Gunung Gede-Pangrango National Park)

BIOGEOGRAPHICAL PROVINCE 4.22.13 (Java)

LEGAL PROTECTION Although officially declared a national park, Indonesian conservation legislation does not yet make any provision for national parks. The proposed national park consists of several parts, each with its own legal status. Cibodas-Gunung Gede and Cimungkat are strict nature reserves (cagar alam), Situ Gunung is a forest recreation area (taman wisata), and the rest is protection forest which in practice has been selectively logged. Decrees concerning the proposed national park are listed in the management plan (UNDP/FAO, 1978).

DATE ESTABLISHED Proposed as a national park on 6 March 1980. The primary forest above the Cibodas Botanical Gardens (established approximately in 1830) was first protected by including it in the gardens on 17 May 1889 (Besluit No. 50). This decree was revoked on 5 January 1925 when a much larger area was established as the Cibodas-Gunung Gede Nature Reserve (Staatsblad No. 7). Cimungkat, part of the protection forest on the southern slopes of Gunung Pangrango, was declared a strict nature reserve on 11 July 1919 (Staatsblad No. 83). The lake Situ Gunung, just east of Cimungkat, together with a large area of secondary vegetation, was declared a forest recreation area on 27 November 1975 (Skpt Mentan 461/Kpts/Um/31/75). Cibodas-Gunung Gede Nature Reserve was a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Lies in the Province of West Java, within the administrative districts of Bogor, Cianjur and Sukabumi. The summit of Gunung Pangrango, which is approximately central, is situated at 5°46'S, 106°58'E.

ALTITUDE 1,000-3,019m

AREA Approximately 140,000ha, including Cibodas-Gunung Gede (1,040ha) and Cimungkat (56ha) nature reserves Situ Gunung Recreation Forest (120ha).

LAND TENURE Government

PHYSICAL FEATURES The park is dominated by the twin Quaternary volcanoes of Gunung Gede (2,958m), and Gunung Pangrango (3,019m) connected by a high saddle above 2,400m at Randang Badak; the older Pangrango is now extinct, while Gede is semi-active with a well-defined crater, hot water springs and several active fumaroles. There are many small and more recent craters, notably Kawah Lanang which produced lava beds as late as 1748 and erupted stones and ash in 1947. The slopes are steep, with many deep gullies incised by stream gullies. Numerous rivers originate from the mountain slopes, including the Ciliwung, Cisadane and Cilaku. Soils on the higher slopes are andosols derived from the underlying igneous rocks and ash. They are dark in colour and highly porous. On the lower slopes, soils are more weathered with a mixture of andosols and latosols, the latter having a clay content but are not sticky. Lower down, deeply weathered and highly fertile latosols are predominant. Cibodas is in the wettest part of Java, with an annual rainfall of between 3000 and 4200mm, falling mostly between October and May. The higher slopes are often cloud-covered but receive less than 100mm of rain during the 2-3 month dry season. Annual temperature varies from about 18°C in Cibodas to less than 10°C on the top of Gunung Pangrango (UNDP/FAO, 1978).

VEGETATION Principal vegetation types are: lowland rain forest (5%), montane/submontane rain forest (85%), subalpine or elfin forest (5%), and grass plains (alun-alun meadows)(5%). The montane rainforest, the finest

example extant in Java, is characterized by conifers Podocarpus spp., laurels Litsea spp., oaks Lithocarpus spp. and Quercus spp., chestnuts Castanopsis spp. and Schima wallachi, which often dominate the canopy at 1,400-2,400m. Leptosperma flavescus, present above 1,750m, is dominant at higher altitudes. There is a rich understorey, with herbs, shrubs and ferns. Many epiphytes, including some 208 species of orchids, festoon the trees. The subalpine forest includes many north temperate genera such as Ranunculus, Viola, Vaccinium, Sanicula and Primula, often with endemic Javan species. Ericaceae form an important component of the forest with Vaccinium varingiaefolium as the predominant tree species. The forest floor is covered in moss, as are the trees and rocks. The volcanic activity of Gunung Gede is responsible for its sparser forest, with less moss and fewer epiphytes. The grassy plains below the edge of Gunung Gede crater are dominated by Javan edelweiss Anaphalis javanica. Also present are the gentian Gentiana quadrifaria, terrestrial orchid Thelymitra javanica, bramble Rubus lineatus, and the grasses Isachne pangerangensis, Agrostis infirma and Calamagrostis australis. Four orchids are endemic to Gunung Gede: Corybas mucronatus, Liparis biloburlata, Malaxis sagittata and Pachycentria varingiaefolia. Other notable plants include the orchid Platanthera blumii, Ormosia pengangensis, and Dendropthoe magna, a parasite of Castanopsis acuminatissima which is only found elsewhere on Mount Kinabalu in Sabah.

FAUNA Threatened mammals include the Javan gibbon Hylobates moloch (E) and Javan leaf monkey Presbytis aygula, both confined to the lower slopes. The leopard Panthera pardus (V) is found throughout the park, and wild dog Cuon alpinus (V) may be present. A list of mammals is given in the management plan (UNDP/FAO, 1978). Some 245 species of birds have been recorded from the park and surrounding regions, including pygmy tit Psaltria exilis, a genus endemic to West Java, peregrine falcon Falco peregrinus (V), mountain thrush Turdus poliocephalus, vernal hanging parrot Loriculus vernalis and Reinwardt's trogon Harpectes reinwardti (UNDP/FAO, 1978). Andrew (1985) provides a checklist of birds recorded in the Cibodas-Gunung Gede Nature Reserve and Botanical Gardens.

CULTURAL HERITAGE Little is known of the early history of the area, which was covered with dense primary forest and remained inaccessible to man until the nineteenth century.

ZONING/CONSERVATION MANAGEMENT The proposed system of zonation includes an intensive use area (3ha) administrative buildings, information office, restaurant; wilderness zone, in which minimal development for tourism is allowed; and a sanctuary zone, to which access is restricted to scientists with special permission and to patrols. A buffer zone around the proposed national park, in which local people are allowed to collect for firewood and renewable resources, is also under consideration. The proposed national park contains the finest examples of montane and elfin forest of that type in Java and is the type locality for many plant and animal species. The forested mountains are of primary importance as the water catchment area of the lower tea gardens, vegetable cultivations and rice fields and also as the source of several main rivers. In view of its accessiblity from major population centres, such as Jakarta, Bandung and Bogor, it also has great recreational and educational values. Objectives outlined in the management plan include: to conserve the montane forest and other ecosystems, subject to a minimum of interference to provide for the continued survival of endangered species of plants and animals; to encourage all research consistent with the objectives of a national park; to provide for tourism in so far as this is compatible with conservation objectives; and to foster an understanding of the importance of the park among local people and visitors (UNDP/FAO, 1978).

STAFF 80, including five supervisors, 63 guards, 12 administrative staff.

LOCAL ADMINISTRATION Kapala Taman Nasional (Chief Ranger/Superintendent), Ir. Syarif Bastaman Jl. Raya Cibodas, PO Box 3, Sdl Cipanos Cidujur.

VISITOR FACILITIES The Cibodas Botanical Gardens, one of Indonesia's most popular resorts, received nearly 200,000 visitors in 1977, only a few of whom visited the adjacent nature reserve. The majority of visitors to Cibodas-Gunung Gede Nature Reserve are young people who climb Gunung Gede at night in order to watch the sunrise from the crater wall. These were over 20,900 visitors to the nature reserve in 1978, only a few of whom were foreigners (UNDP/FAO, 1978). Facilities include an Environmental Education Centre adjacent to the park, plus several camping grounds within the park.

SCIENTIFIC RESEARCH AND FACILITIES The area has a long history of research going back to the early nineteenth century, full account is given to the management plan (UNDP/FAO, 1978). Large collections of plants were made by J. van Hasselt and H. Kuhl in 1821, C.L. Blume, director of the Bogor Botanical Gardens, in 1839-1861, and C.G.G.J. van Steenis, Director of Leyden Herbarium in 1924-1940 and 1950-1952. J.E. Teysmann, who was appointed curator of the Cibodas Botanical Gardens in 1830, experimented with the aclimatisation of economically important plants, of which cinchona used to cure malaria is among the best known. S.H. Koorders started to map individually marked trees in 1890 for the collection of material in flower and fruit; this work was later extended by Bruggeman and later by Baas Becking, who studies the effect of aging on forest composition. F.W. Went pioneered a study on the sociology of epiphyte in 1940. More recently, Hoogerwerf (1949) wrote a monograph on the birds of Cibodas. Forest composition has been studied by Kartawinata (1976), Kyoto University (Japan) and also by Rollet of Unesco, as part of the MAB Programme. The amphibians have been studied by Liem (1973).

LOCAL POPULATION The proposed national park is uninhabited but the surrounding area is one of the most densely populated regions in Java.

MODIFICATION OF THE NATURAL ENVIRONMENT Disturbances include: agricultural encroachment around the inadequately marked boundaries; severe impact of visitors, including vandalism and the collection of mountain wild flowers; and the collection of firewood and other forest products by local residents. The southern parts of the proposed national park were extensively logged prior to their incorporation.

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Komodo Proposed National Park

BIOGEOGRAPHICAL PROVINCE 4.23.13 (Lesser Sunda Islands)

LEGAL PROTECTION Total protection of fauna and habitat

DATE ESTABLISHED Declared a national park on 6 March 1980, but legislation specifically designed for establishing national parks is still lacking. Padar and part of Rinca were first protected as nature reserves in 1938. Komodo was first protected as a suaka margasatwa (game reserve) on 12 October 1965 (Ministry of Forests Decree No. 66). Designated a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Lies just off the west coast of Flores in the province of Lesser Sundas. 8°24'-8°50'S, 119°21'-119°49'E.

ALTITUDE 0-735m

AREA 70,000-72,000 (Komodo Island: 33,937ha, Rinca Island 19,825ha, Padar: 2,017, and surrounding marine waters: 10,000-12,000ha. The 30,000ha Biosphere Reserve is on Komodo Island.

LAND TENURE Central Government

PHYSICAL FEATURES The proposed national park comprises the islands of Komodo, Rinca and Padar, together with numerous small offshore islands and surrounding marine waters. It lies within the inner volcanic arc of the Lesser Sundas, a geological "shatter belt" between the Australian and Sunda tectonic plates. The islands were formed primarily from Pleistocene and recent deposits and are generally rugged. Sheer cliffs, small bays and inlets, and numerous coral reefs and powerful offshore currents isolate and protect the islands. Periods of rising and falling sea level, fractures, faulting and geological submergence which have resulted in large areas of soft ash and conglomerates being among the hard volcanics and some areas of coral reefs being 200m above sea level. Komodo has a chain of generally rounded hills averaging 500-600m, along the north-south axis. Gunung Toda Klea in the north-east is precipitous and crowned by deep, rocky and dry gullies. Padar is a narrow, low island with rocky peaks rising 300m from the surrounding grassland. Rinca, 150m from Flores, comprises mainly rolling hills, but the south is dominated by the sprawling Doro Ora (667m) and the north has the low but steep peaks of Gunung Tumbah (187m) and Doro Raja (351m). Gunung Satalibo is the highest peak at 735m. The proposed national park is in one of the driest parts of Indonesia, an annual rainfall of with 800-1000mm less than 200mm falls in 11 months of the year. The north-west monsoon occurs from January to March; the south-east winds are consistently strong and sea conditions rough in August; and the weather is hot and dry with temperature around 40°C from September through December.

VEGETATION Comprise dry lowland monsoon forest interspersed with extensive areas of savanna, but lacking the predominance of Australian-derived trees found further east in Timor. Vegetation classes are: tall-grass woodland

savanna and tropical tall-grassland (70%); tropical drought-deciduous woodlands (25%); and mangrove forest (less than 5%). The thorny, open monsoon forest survives mainly on the upper parts of hills and in moist valley bottoms. Common species include Sterculia foetida, Oroxylum indicum, Tamarindus indica and Zizyphus horsfieldii. The dominant tree in the savanna is Lontar palm Borassus flobellifoer, often occuring in scattered clumps. Grasses include Setaria adhaerens, Chloris barbata, Heteropogon contortus and in the higher areas, Themeda spp.. Mangroves occur in the sheltered bays, sometimes bounded on the landward side by large stands of Avicennia marina. Rhizoporastylosa spp. and R. mangle are predominant. Along the beaches are areas of typical beach vegetation, including Ipomoea pescaprae, Spinifex littoreus and Cassutha filiformis.

FAUNA The area is famous for the Komodo dragon (locally called ora) Varanus komodoensis (R). Discovered in 1910, it is found only on Komodo, Rinca, Padar and in certain coastal regions of West Flores. It is the world's largest living lizard, with males often weighing over 90kg and exceeding 3m in length. With a population of about 5,000, it occurs in all habitats. Adults scavenge or hunt pigs Sus scrofa, Timor deer Cervus timorensis, crab-eating macaques Macaca fascicularis and feral domestic animals (including horses on Rinca island), while immatures feed on birds, eggs, carrion (including fish on beaches) and rats (including the endemic Rattus rintjanus). The breeding season is June to July; the 25-30 eggs in a clutch are buried in sand or dead leaves and hatch after an 8-month incubation period. Other fauna is rather poor, but is characteristic of the Wallacean zoogeographic region, with seven species of terrestrial mammals and 72 species of birds, including lesser sulphur-crested cockatoo Cacatua sulphurea, the megapode Megapodius freycinet and noisy friarbird Philemon buceroides. The coral reefs fringing the coast of Komodo are diverse and luxuriant due to the clear water, intense sunlight and rapid exchanges of nutrient-rich water from other areas of the archipelago. The marine fauna and flora are generally the same as those found throughout the Indo-Pacific area. Blue whales Balaenoptera musculus (E), sperm whales and dolphins are frequently seen in the straits and the spotted whale shark is occasionally encountered. Dugongs and five different species of sea turtles are present, but both are becoming increasingly rare.

ZONING/CONSERVATION MANAGEMENT A system of zonation has been proposed (FAO, 1977) and subsequently modified (Robinson et al. 1982). Village enclaves, administration, visitor accommodation and the airstrip are contained within an intensive use zone. Developments are limited to trails, guardposts and visitor camps in wilderness zones, while access to sanctuary zones is strictly limited to scientists and patrols. All types of zones include seaward strips up to 1,000m offshore. The principal objective is related to conserving the Komodo dragon. Even without a legal basis, Komodo is in the process of being developed as a national park, generally following the guidelines outlined in the 1977 management plan (Robinson et al., 1982).

STAFF 75, including supervisors, 39 guards and 30 administrative (1984)

LOCAL ADMINISTRATION Kepala Taman Nasional (Chief Ranger/Superintendant), Jl. Jend, Subirwan No. 87, Labuan Bajo Ruteng, Nusa Tenggara Timur.

VISITOR FACILITIES Access is difficult but potential for tourism is high, particularly for special interest groups. Local fishing boats may be chartered from Sape, or there are regular passenger boats from Labuan Bajo (4 hours to Komodo). Access by air and by road is being developed. A park headquarters, visitor accommodation and visitor cenre have been developed in the Loho Liang area on Komodo. The number of visitors (1500 in 1984) is

expected to increase greatly once national park development is completed. Entry is by permit and is available from PHPA offices or from the park authorities.

SCIENTIFIC RESEARCH AND FACILITIES Komodo dragon (Auffenberg, 1969-70); ecological survey (Hoogerwerf and Juysman, 1953).

LOCAL POPULATION Kampong Komodo is the only settlement inhabited by indigenous Komodo people, but there are several other small enclaves within the proposed park boundaries totalling some 1,000 people. The principal occupation is fishing and collection of other marine products.

MODIFICATION OF THE NATURAL ENVIRONMENT Disturbances include illegal felling of timber and poaching of Timor deer (prey of the Komodo dragon); feral dogs which compete with the dragon for food; fires, caused by poachers, which have reduced the remaining natural forest, leading to serious erosion; and illegal fishing using explosives. Relationships between park authorities and the enclave villages of Komodo and Rinca have not improved significantly. Provincial government proposed in 1980 that the Kampung Komodo be relocated to a site near Lauan Rajo, but the villagers have refused to be moved. The illegal settlements on Rinca's east coast have not been removed. (Kvalvagnaes and Halim, 1979; Robinson et al.; 1982).

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Lore Lindu Proposed National Park

BIOGEOGRAPHICAL PROVINCE 4.24.13 (Sulawesi Rainforest)

LEGAL PROTECTION Fauna fully protected, restricted use of habitat. Although proposed as a national park at the Bali Third World National Parks Congress on 14 October 1982, Indonesian legislation does not yet make provision for national parks.

DATE ESTABLISHED The area, comprising three separate units, was officially proposed as a national park on 14 October 1982. Lore Kalamanta was created a Suaka Margasatwa (game reserve) on 20 October 1973 (S.K. No. 522/kpts Um 10 1973), Danau Lindu a hutan wisata/lindung (protection forest) in January 1978 (S.K. No. 46/Kpts/Um/1/1978) and the proposed extension to the Suaka Margasatwa Lore Kalamanta, which is already being developed as part of the proposed national park. Designated a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Situated in the mountains of central Sulawesi, approximately 60km south-east of Palu. Lore Lindu is bounded by the Fossa Sarasina Rift to the west and the Tawaelia Rift to the east, both of which converge in the Bada Valley at the southern extremity. The north is bounded by the Palolo-Sapu Valley. 1°40'S, 120°10'E.

ALTITUDE 200-2,610m (Gunung Rorekatimbu). Approximately 70% of the proposed national park lies between 1,000m and 1,500m and only 10% below 1,000m.

AREA 231,000ha

LAND TENURE Central Government

PHYSICAL FEATURES The whole area is composed of complex, steeply-folded mountains, highest in the north-east, where the major peaks are Gunung Nokilalaki (2,355m) and Gunung Rorekatimbu (2,610m). The mountains are primarily of Pliocene and Miocene age, though Nokilalaki is of Paleozoic origin. There is no active volcanism, but tectonic movements are occasional and in 1902 a severe earthshake destroyed a village. Hot sulphur springs occur along fault lines. Valleys between the mountains are filled with Pleistocene and Recent sediments and lacustrine deposits. Dauna Lindu, the only large lake, is drained by the Gumbasa River, which is important for irrigating the arid Palu Valley in its lower reaches. It is also Indonesia's main site of schistosomiasis endemism. Valley soils, derived from terrace and lake deposits and local alluvial fans, range from well-drained sand or stony soil to deep and poorly drained alluvium. Mountain soils are derived mostly from acidic rock, including gneisses, schists and granite. Being in the centre of Sulawesi, the climate is less influenced by the sea than in most other parts of the island. Lore Lindu has a tropical monsoon climate with an annual rainfall of 2000-3000mm in the north, increasing to 3000-4000mm in the south. Rainfall is concentrated in the period of the western monsoon from November to April.

VEGETATION A detailed description is given by Watling and Mulyana (1981). In general, 10% of the area below 1,000m is lowland rain forest. This is heterogenous in floristic composition with no dominant species except beside some rivers and streams where Eucalyptus deglupta is the dominant emergent. Common emergents in the lowland rain forest are Octomeles spp., Engelhardia spp., Ficus spp. and Canangium spp.. The bulk of the vegetation is montane rain forest, which is characterised by the dominance of Castanopsis spp. and Lithocarpus spp. Agathis philippensis forms dense stands on some of the larger ridges. The Coniferae are well-represented by Podocarpus and Phyllocladus. Other common trees are Elaeocarpus spp., Adinandra spp., Lasianthus spp., Cinnanmomum spp., Litsea spp. and Callophyllum spp. The undergrowth is usually dense at low altitudes and sparse on ridges. It consists mainly of ferns, orchids and various Rubiaceae and Urticaceae. Sub-alpine vegetation is restricted to narrow ridges at or above 2,000m. Here, the forest is generally dominated by Leptospermum and Rapanea or Myrsine, which grown uniformly and the stems of these trees are thickly covered by mosses. The grasslands, undoubtedly anthropogenic, are dominated by Themeda gigantea and Poa nudusa.

FAUNA Most of Sulawesi's endemic mammals and 66 (83%) of her endemic avifauna have been recorded in or around the proposed national park. Mammals, birds, reptiles, amphibia and fish recorded in Lore Lindu are listed in the management plan (Watling and Mulyana, 1981). Threatened mammals include both Sulawesi anoas Bubalus depressicornis (E) and B. quarlesi, babirusa Babyrousa babyrussa (V) and the Sulawesi palm civet Macrogalida musschenbroekii (R). Other endemics include the Celebes macaque Macaca nigra, spectral tarsier

Tarsius spectrum and the Sulawesi cuscus Phalanger celebensis. The Sulawesi cuscus and the more widespread and larger P. ursinus are the only marsupials found as far west as Sulawesi. A total of 194 species of birds have been recorded in Lore Lindu and its immediate proximity: this is 73% of Sulawesi's land birds. Among the endemics are some of the rarest species in Sulawesi: Celebes rail Aramidopsis plateni, Celebes woodcock Scolopax celebensis, Minahassa owl Tyto inexspectata and Celebes mountain thrush Geomalia heinrichi. There are at least six nesting grounds of the endemic Macrocephalon maleo, all of which receive the heat necessary for the incubation of the eggs from underlying hot springs. The most commonly observed snakes are racers, Elaphe erythrurad and E. janseni, mock viper Psammodynastes pulverulentus and Xemopeltis unicolor. The python Python reticulatus is common below 1,000m and king cobra is often present near water. Of the 11 species of lizard, one is an undescribed species of Leiolopisma. The endemic Sphenomorphus nigrolabris is semi-aquatic. Twelve amphibians have been identified, including an undescribed species of Oreophryne. Six species of fish occur in Lake Lindu, of which Anabus testudimus is indigenous.

CULTURAL HERITAGE The three valleys of Lore-Besoa, Napu and Bada contains perhaps the finest group of megaliths (stone images, large urns and other relics) in Indonesia. With one or two exceptions, all of the megaliths lie outside the demarcated boundary. There are seven closely related ethnic groups around the proposed national park, all with distinct dialects/languages. Together they form the bulk of the people loosely classified as Western Toraja. A century ago, these people lived in small working clans, practised swidden agriculture and took refuge in fortified stockades. Largely under the influence of Christian missionaries, they have made an almost complete transition to a settled village life, farming sawah (Watling and Mulyana, 1981).

ZONING/CONSERVATION MANAGEMENT A system of zonation has been proposed whereby the subsistence needs of villages would be met with a traditional use zone and development for tourism would be contained within a development zone. The rest of the area would be designated a wilderness zone. Sanctuary zones, to which entry is strictly controlled, may need to be introduced. Buffer zones need to be established outside the proposed national park to provide for the long term needs of nearby villagers (Watling and Mulyana, 1981). Objectives outlined in the management plan include: conserving viable populations of wildlife, with particular reference to animals and plants endemic to Sulawesi; maintaining the present spectrum of habitats; protecting the natural forest cover of the mountains for the benefit of lowland human populations dependent on the catchment area for their water supplies; and utilizing the area for educational, recreational and scientific purposes in so far as is compatible with conservation aims.

STAFF 65, including seven supervisors, 15 administrative staff and 43 guards (1984).

LOCAL ADMINISTRATION Kepala Sub Balai (Park Warden), Kotak Pos 2, Palu, Central Sulawesi.

VISITOR FACILITIES There is a visitor centre, shelter and trails. Campsites are situated by rivers thoughout the area.

SCIENTIFIC RESEARCH AND FACILITIES Details of collections of the flora and fauna are given by Watling and Mulyana (1981). The ecology of the area has been studied by Wirawan (1981). Recent ornithological work has been

undertaken by Watling (1983). The ecology of the palm civet was studied by Wemmer and Watling (1986). There are no scientific facilities.

LOCAL POPULATION Approximately 30,000 people live adjacent to the boundary of the proposed national park, of which 4,550 reside in the Besoa and Lindu enclaves. The majority of these people still rely on the forest resources from within the proposed national park. In addition, the villages of Katu and Dodolo, with a combined total of 66 families, are within the demarcated boundary but they are due to be re-located outside (Watling and Mulyana, 1981).

MODIFICATION OF THE NATURAL ENVIRONMENT The continued collection of forest produce, particularly rattan, and of megapode eggs uncontrolled hunting and shifting cultivation are the main problems. The Gumbasa Irrigation Scheme, designed to irrigate 11,500ha of the Palu Valley, is threatened by highly erodable soils in the catchment area. Its success and the livelihood of many people in the densely populated Palu Valley will depend on adequate protection of the catchment within the proposed national park.

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WWF Project No. 1526. Lore Lindu National Park, Central Sulawesi, Indonesia.

Tanjung Puting Proposed National park

BIOGEOGRAPHICAL PROVINCE 4.25.13 (Borneo)

LEGAL PROTECTION Fauna is fully protected; habitat can be "managed". Although proposed as national park at the Bali Third World National Park Congress on 14 October 1982, Indonesian legislation does not yet make provision for national parks.

DATE ESTABLISHED Proposed as a national park on 14 October 1982. First protected as a game reserve on 13 June 1936 (Local Government Decree No. 24). Designated a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Forms large triangular cape on the south coast of the province of Central Kalimantan. It lies between Kumai Bay in the west, Surujan River in the east, and Sekunyer River in the north. 2°35'-3°20'S, 111°50'-112°15'E.

ALTITUDE Ranges from sea level to 100m

AREA 355,000ha. The Biosphere Reserve covers 205,000ha.

LAND TENURE Central Government

PHYSICAL FEATURES Comprises a swampy, low-lying peninsula formed primarily of recent alluvium; it is a relict of the Sunda peneplain, which was exposed during low sea level periods that corresponded to ice ages in the northern latitudes, submerged by rising sea levels as ice caps melted, and then filled by alluvial deposits from Tertiary and pre-Tertiary formations of central Borneo. Flooding is frequent and there are several black-water rivers. Soils are very acidic, with occasional deposits of peat up to 2m thick. Rainfall averages 2200-2500mm per year, with no pronounced dry season but considerable annual variation.

VEGETATION Lowland rain forest constitutes 50%, swamp and bog forest 45%, and mangrove forest 5% of the area. The rain forest contains many dipterocarps, such as Shorea spp., and Dipterocarpus spp., along with Myristica spp., Castanopsis spp. and Lithocarpus spp.; ulin (ironwood) Eusideroxylon zwageri spp. is common but heavily poached because of its great value. The heath forest is predominated by trees less than 30m tall and 2m in diameter. Typical genera include Dacrydium, Eugenia, Hopea and Diospyros. Mixed swamp forest is the most species-rich tropical swamp forest, with trees featuring stilt roots, pneumatophores and numerous epiphytes. The two main types are: raman peat swamp, characterized by Gonostylus bancanus, Palaquium spp., Campnosperma spp., Shorea spp., Dyera costulata, Semecarpus spp. and Alstonia spp.; and transitional swamp forest with Castanopsis spp., Schima spp., Durio spp. and Eugenia spp.. The mangrove forest with Sonneratia spp. and Rhizophora spp., is only poorly developed. A thick mat of floating herbaceous plants, believed to be Susum malayanum, grows profusely along the Sekonyer Kiri and Sekonyer Kanan and could block the waterways.

FAUNA The area is famous for orang-utan Pongo pygmaeus (E), which occurs at a density of 2 per sq.km. Also at least 7 other primates are present, including proboscis monkey Nasalis larvatus (V) (at a density of 94 per sq.km along the Sekonyer river system), and agile gibbon Hylobates agilis (at a density of 7 per sq.km), maroon leaf monkey Presbytis rubicundus, crab-eating macaque Macaca fascicularis and pig-tail macaque M. nemestrina. The area contains many mammals typical of Kalimantan, including clouded leopard Neofelis nebulosa (V), sun bear Helarctos malayanus, and sambar Cervus unicolor. The avifauna has not been studies in detail. Of particular interest is the presence of the false gavial Tomistoma schlegelii (E), considered to be common in the Sekonyer Kanan River.

ZONING/CONSERVATION MANAGEMENT None

STAFF 76, including six supervisors 62 rangers and eight administrative staff (1984)

LOCAL ADMINISTRATION Kepala Taman Nasional (Chief Ranger/Superintendant) IR, Rachmat Kosail, Jl. Jend. Sutoyo Miharjo, Palangkaraya, Central Kalimantan.

VISITOR FACILITIES There is an information centre, guest house, shelters and trails. Visitors numbered less than 100 per year in 1979.

SCIENTIFIC RESEARCH AND FACILITIES Research on the orang-utan has been conducted since 1971 (Galdikas-Brindamour, 1978). By 1979, 15 research projects leading to master's degrees had been completed by Indonesian students. A preliminary survey of the proboscis monkey has been undertaken (Bismark, 1981). At the research station, "Camp Leakey", established by Brindamour, facilities include a three-bedroom guest house, student house, 16m

high observation tower, kitchen-dining hall, and a small herbarium. There are 130km of transect trails and 2km of bridged trails in swamps.

LOCAL POPULATION There is one illegal village of about 100 people.

MODIFICATION OF THE NATURAL ENVIRONMENT The ecosystem has been subsequentially modified along the Sekonyer River, due to logging activities. Some areas are seasonally occupied by fishermen or gatherers of forest produce. There is illegal shifting cultivation occuring in the north. Effective control or management by conservation authorities is lacking. Growth of Susum malayanum on the rivers is an increasing problem, blocking the flow of water and impeding the passage of boats. The left bank of the Sekonyer (just outside the proposed national park) is being developed for agriculture increasing human pressure on the park.

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WWF Project No. 1523

Gunung Leuser Proposed National Park

BIOGEOGRAPHICAL PROVINCE 4.21.13 (Sumatra)

LEGAL PROTECTION Varies from total protection of flora and fauna to protection of fauna only, with managed habitat in areas of planned recreational use.

DATE ESTABLISHED Declared a national park on 6 March 1980, but legislation specifically designed for establishing national parks is still lacking. The proposed national park comprises the former Leuser (3 July 1934), Kluet (30 September 1936), Langkat and Sikundur (30 October 1938) and Kappi (10 December 1976) reserves. Strien (1978) gives a detailed account of the complex history of establishment. Declared a Biosphere Reserve in 1981. It is also an ASEAN Heritage Site.

GEOGRAPHICAL LOCATION Lies west of Medan City in the Bukit Barisan of northwestern Sumatra. It is almost split in two by the long Alas Valley, which runs north-south. The western half (Gunung Leuser Reserve and Kluet Reserve) is linked in the north to the eastern half (Sikundur, Langkat and Serbolangit reserves) by the Kappi Reserve. Approximately 3°-4°N, 97°-98°E.

ALTITUDE 0-3,381m (Gunung Leuser). Altitudinal zones are: 3% 0-300m, 9% 300-600m, 48% 600-1,500m, 35% 1,500-2,500m, and 5% above 2,500m.

AREA 946,400ha (Gunung Leuser: 531,585ha, Serbolangit: 51,725ha, Kluet: 23,425, Sikundur: 64,565ha, West Langat: 77, 675ha, Kappi: 150,225ha)

LAND TENURE Central Government

PHYSICAL FEATURES This predominantly mountainous, U-shaped area is about 150km from north to south along the backbone of the Bukit Barisan and about 135km from the low coastal plains of Sikundur in the north-east to the coastal border of Kluet in the west. The mountains are composed of Palaeozoic metamorphics, added to by a long series of sedimentary and volcanic events throughout the Oligocene and Miocene when faulting in a SE-NW direction produced several rift-valleys. The heavily populated Alas Valley, which is the largest of Sumatra's three major rift-valleys, cuts through the centre of the proposed national park and is capped by the Kapi Plateau, which undulates slightly and two small volcanic cones. Recent geological activity has resulted in solfatara and fumaroles on and around the plateau. The climate is variable with mean annual rainfall varying from 1300mm (in rain shadow areas) to 4700mm. In Ketambe at 330m, mean daily minimum and maximum temperatures are 21.1°C and 27.5°C, respectively.

VEGETATION Montane/sub-montane rain forest with cloud forest is extensive. There are relatively small areas of lowland rain forest in Sikundur, Kluet, Bengkong (Leuser), and including the foothills of West Alas Valley and Langkat. Other vegetation types include Northern pine forest Pinus merkusii, riverine forest; swamp and bog forest, mainly in the Kluet area and short-grass shrub savanna or "blangs" on the tops of the highest mountains where the low vegetation of grasses, sedges, herbs and dwarf shrubs includes many north temperate genera such as Rhododendron spp., Vaccinium spp., Parnassia spp. and Gentiana spp.. It is estimated that 2,500 to 3,500 of the 9,000 plant species known from Sumatra are present with some 25-30% (600-1,000) of these known to be useful: commercial trees such as Dipterocarpus spp., Shorea spp. and the threatened camphor tree Drypbalanops aromatica; fruit trees such as the durians Durio oxleyanus and D. zibethinus, menteng Baccaurea spp. and B. racemosa, rukum Elacourti rukum, duku Lansium domesticum, banana Musa spp., citrus jeruk Citrus macroptera, rambutan Nephelium lappaceum, and several species of jambu Eugenia and Syzygium; rattans and other palms including daun sang or the giant leaf palm Johannesteijsmannia albifrons; Styrax spp. for medicines; and benzoin and Cinnamomum spp. for medicines and spices. 171 plant species are known to have medicinal uses (Elliott and Brimacombe, 1985). The area is important for the genetic conservation of such species. The world's largest flower Rafflesia arnoldii (V) also occurs here.

FAUNA More than half of Sumatra's vertebrate fauna is represented, largely in the lowland areas. Of 512 species (105 mammals, 313 birds, and 94 reptiles and amphibians), 350 have been recorded only in the tropical zone (i.e. below 1,000m). A list of species is given in the management plan (Strien, 1978). Threatened species include orang utan Pongo pygmaeus (E), siamang Hylobates syndactylus (V), Sumatran tiger Panthera tigris (E), golden cat Felis temmincki, clouded leopard Neofelis nebulosa (V), elephant Elephas maximus (E), Sumatran rhino Didermorcerus sumatrensis (E), Sumatran serow Capricornis sumatraensis sumatraensis (E), and false gharial Tomistoma schlegelii (E). The area contains one of the most extensive elephant habitats in Sumatra. The avifauna includes all nine hornbills (Bucerotidae) occurring in Sumatra and five pheasants: great argus Argusianus argus, crested fireback Lophura ignita, Salvadori's pheasant L. inornata, Malaysian peacock pheasant Polyplectron malacense and red jungle-fowl Gallus gallus.

ZONING/CONSERVATION MANAGEMENT Proposed management zones are: a development zone for tourism and a wilderness zone with restricted public access and limited development; and a sanctuary zone, to which access is permitted only

for scientific research. It is also proposed that buffer zones be established around the park, as a resource area for nearby populations. Gunung Leuser is probably the single largest area of undisturbed habitat remaining in S.E. Asia; it is unique on account of its variety of landscapes and ecosystems, ranging from the sea coast to the highest mountain tops, and it provides important habitat for some of the world's most endangered species. It was identified by the Indonesian Delegation to the 10th General Assembly of IUCN, 1969 as an area of conservation priority, following which a preliminary survey was carried out by Kurt (1970). A management plan was subsequently prepared in which particular emphasis is given to protecting the Sumatran rhino (Strien, 1978). Gunung Leuser was identified in IUCN's Tropical Plants Campaign, 1982. Management measures already implemented include: demarcation of boundaries; establishment of an SSB radio link between Kutacano and Medan; development of an agricultural improvement scheme in the enclaves on the Kutacano-Blankedjeren road. The research and orang utan rehabilitation programmes are progressing including the research area at Ketambes.

STAFF 162 (eight supervisors, 32 administrative staff and 142 guards).

LOCAL ADMINISTRATION Kepala Taman Nasional (Chief Ranger/Superintendant), Jl. Tamal menah, PO Box 16, Kutacane, Aceh Tenggara.

VISITOR FACILITIES There is a visitor centre and information centre. Shelters and guest houses are available.

SCIENTIFIC RESEARCH AND FACILITIES Strien (1978) provides an historical account of research undertaken in the area. More recent work includes studies of orang utan (Rijksen, 1978; MacKinnon, 1974), Sumatran rhino by M. Borner and pig-tailed macaques by Y. Robertson. W.J.J.O de Wilde and B.E.E. de Wilde-Duyfjes (State Herbarium, Leiden) made botanical collections around Kerambe and on the Bandahara in 1972, and J. Krikken (National Museum of Natural History, Leiden) made entomological collections in Alas Valley. Facilities available at the Ketambe Research Station include accommodation, library, laboratory, and a orang utan rehabilitation centre (opened in 1971). The lowland forest is marked out with quadrats, which are well-maintained. A second rehabilitation centre for orang utans was opened at Bukit Lawan in 1973. It includes an education centre.

LOCAL POPULATION There are two settlements, within the area, both of which are situated in the Alas Valley. Marpunga, with an area of 1456.4ha, contains 256 families (about 1,700 people). The population at Gumpang, which covers an area of 1893.8ha, has recently doubled due to two translocations into the area. It now numbers about 2,500 people (375 families). The economy is based entirely on agriculture, with most families owing 1-2ha of land (Elliott and Brimacombe, 1985).

MODIFICATION OF THE NATURAL ENVIRONMENT The heavily populated Alas Valley bisecting the park represents the most serious long-term threat. The opening of the new highway being constructed through the Kappi sector will make the forests easily accessible to loggers and shifting culivators. There is growing pressure to enlarge the enclaves along the line of this road in order to grant timber concessions to outsiders. In addition to damaging the enclaves, officials are now pressing for clearance of a strip of forest extending 2km on each side of the road for a distance of 15km (total 6000ha) for agricultural development. This would remove the bridge of forest which still remains across the Alas Valley, finally cutting the reserve in half and forming a barrier to the movement of wildlife. Clearing of forest in the upper Alas valley is leading to flood damage in the lower Alas. There are

sawmills in the Alas Valley and coffee plantations are spreading along the reserve boundaries.

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Siberut Nature Reserve

BIOGEOGRAPHICAL PROVINCE 4.21.13 (Sumatran)

LEGAL PROTECTION Flora and fauna are fully protected.

DATE ESTABLISHED 25 October 1976 (Ministerial Decree No. 670). Subsequently enlarged to 56,500ha in 1979. Designated a Biosphere Reserve in October 1981.

GEOGRAPHICAL LOCATION Siberut is the largest of the Mentawai Islands which lie off the west coast of Sumatra. 98°35'E, 1°10'S.

ALTITUDE 0-384m

AREA 56,000ha. Includes part of the existing Teitei Batti Reserve (65,000ha).

LAND TENURE Central Government owned

PHYSICAL FEATURES Siberut is a medium-sized (4,480 sq. km), low island isolated from mainland Sumatra by the 1,500m deep Mentawai basin. Along with the other three Mentawai islands, Siberut has been essentially oceanic for at least 500,000 years and its flora and fauna have evolved in isolation from the dynamic evolutionary events of the Sunda Shelf. Siberut is a sedimentary island, dominated by shales, silts and marls, primarily of Pliocene, Pleistocene and Recent age. Since the hills and ridges of Siberut are all about the same height, Siberut was probably uplifted as a relatively flat surface during the Pleistocene. This was followed by an extremely high rate of erosion which resulted in a strongly dissected and rugged landscape. Thus, the hills rise steeply from the broad river terraces and swamps, and the ridges have been reduced to very steep crests with their direction being almost completely independent of the geological structure. The complex system of rivers and streams is maintained by a wet equatorial climate with no dry season. Mean annual rainfall is 3320mm, with all months receiving 200-400mm.

VEGETATION The natural vegetation is tropical rainforest, a reflection of the even distribution of plentiful rainfall and year-round high temperatures. Lowland rain forest constitutes 90% of the area, riverine forest 3%, freshwater swamp and bog forest 5% and mangrove forest 2%. Primary

dipterocarp forest is confined to high ridges and hills, with Shorea and Dipterocarpus as the common genera. Species of Palaquium and Hydnocarpus are associates. Primary mixed forest occurs on the slopes and lower hills below the primary dipterocarp forest. Many families of trees are present, such as Myristicaceae, Euphorbiaceae, Dilleniaceae, and Dipterocarpaceae, but none are dominant. Common emergents are species of Shorea, Dipterocarpus, Dialium, Pentace and Durio. Freshwater swamp forest has a specialized and limited tree flora dominated by Terminalia phellocarpa; its ground flora is composed of feather palms, rattans, pandans and aroids, and the ever-wet soil is studded with pneumatophore roots. Mangrove forest, comprising Rhizophora spp. succeeded by Bruguiera spp., is only found on the east coast, where the sea is shallow, with extensive coral reefs. On the west coast, where the strength of the prevailing wind and pounding surf prevents the establishment of mangroves, occur pure stands of Casuarina equisetifolia, interspersed with a low shrub association of Barringtonia spp., Hibiscus spp. and Pandanus spp.. Long isolation from Sumatra has allowed the vegetation to develop independently, with some 15% of plant forms being endemic and vegetation associations quite different from the mainland. This suggests that Siberut's forests could have great inportance as a source of plant genetic resources.

FAUNA The fauna has been even more affected by isolation, with ten endemic species of mammals, out of a total of 27 recorded, including all four of the primates: Kloss's gibbon Hylobates klossi (V), Mentawai macaque Macaca pagensis, snub-nosed langur Simias concolor (E) (an endemic genus) and Mentawai langur Presbytis potenziani (I). The primates have retained many primitive characteristics, making them particularly important for evolutionary studies: the gibbon has the simplest hylobatid colouration and a particularly melodious call, which is ancestral to all other gibbon calls; the Mentawai langur is the only Old World Monkey which lives in permanent pairs, and the more complex "harem" groups of the other langurs may have evolved from such a social organization; and the pig-tailed langur is most closely related to the long-nosed Proboscis monkey of Borneo, but has a pig-like tail, a short snub nose, two colour phases, and two different social structures, clearly a rapidly evolving monkey. The bird fauna includes one endemic species, the Mentawai scops owl Otus mentawi, plus 13 endemic subspecies, including a spectacular crested serpent eagle Spilornis cheela sipora; 27 families of Sumatran birds do not occur on Siberut, giving the avifauna a different composition from that on the mainland.

CULTURAL HERITAGE The indigenous inhabitants, who belong to one of the most archaic cultures in Indonesia represent a tradition which was common to the archipelago during the Stone Age. The traditional economy was a form of shifting cultivation, supplemented by hunting, a lifestyle which has hardly changed for thousands of years. Although small scale clearing of areas for cultivation is necessary the vegetation is not burnt, thereby avoiding the risk of soil erosion. People still hunt with bow and poisoned arrows and have a highly developed "science" of herbal remedies, some of which merit investigation for clinical applications elsewhere. The culture is rapidly being eroded, largely due to influence of missionaries and the governments emphasis on development. Longhouses have been abandoned for villages and a cash economy is developing.

ZONING/CONSERVATION MANAGEMENT A system of zones is proposed to control land use and reconcile the conflicting needs of conservation and exploitation throughout the island. The development zone (250,000ha) includes most land currently being logged, is occupied by the bulk of the population, and has the best potential for sustained logging and agricultural development. The traditional use zone (100,000ha) is to be protected as a suaka margasatwa

(wildlife reserve) and will serve as a buffer to the nature reserve zone (50,000ha) in which wildlife is fully protected. Access to the nature reserve is limited to Mentawaians who may collect forest produce for their own use. Based largely on the work of A.J. Whitten, J. Whitten and A. House, a master plan was prepared in which it was recommended that the entire island be established as a biosphere reserve, including the Siberut Nature Reserve (WWF, 1980). The plan proposes that wildlife should be managed to assure the survival of all species yet allowing traditional hunting to continue under a new system of controls. Emphasis is given to developing the local economy by building on existing cultural elements and providing for limited tourism.

STAFF One only; 12 additional reserve guards were being trained in reserve management under the WWF Siberut Project.

LOCAL ADMINISTRATION Kepala Seksi (Section Officer), Jl. Prof. H. M. Yamin S. H. 7 A, Bukittinggi, Sumatra Barat.

VISITOR FACILITIES Access is difficult and there are no facilities. Less than 100 tourists per year visit the island. Small-scale, low-key tourism development is planned for the future.

SCIENTIFIC RESEARCH AND FACILITIES Recent work includes studies of the gibbons (Tenaza, 1975; A.J. Whitten) and other primates (Tilson, 1977), small mammals (J. Whitten) and botany (A. House). There are no scientific facilities.

LOCAL POPULATION 18,000 indigenous tribal people live on the island.

MODIFICATION OF THE NATURAL ENVIRONMENT Official attempts to modernise the island and its indigenous population have already disrupted the natural harmony of the forest community which could lead to considerable problems in the future. Several development schemes have already been implemented to varying extents: in co-operation with missionaries, the Government has set up 50 villages, in which the indigenous people are encouraged to live, abandoning their own social and cultural traditions; and sago cultivation has been replaced with sawah (flooded-field) rice, which is incompatible with the forest ecosystem. Commercial exploitation has included highly destructive clear fell logging (most of the island falls under logging concessions allocated 10 years ago); collection of rattans; and cutting of mangrove. However, the government commissioned the WWF Master Plan and, if implemented, this unique tropical island could be saved.

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Arasbaran Protected Area

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Totally

DATE ESTABLISHED In 1972 as a Wildlife Reserve and Protected Area and accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION In the Caucasus mountains, on the border with the USSR, 39°07'N, 47°01'E.

ALTITUDE 250-2,887m

AREA 52,000ha

LAND TENURE Government

PHYSICAL FEATURES Arasbaran is an area of high relief and steep slopes, being part of the Caucasian mountain zone of the Aras River Valley, with numerous water sources. Precipitation varies with altitude, from semi-arid to highly humid conditions. Mean temperature is -1.8°C in January and 25°C in July at 2,500m.

VEGETATION Zonation of habitats is quite distinct due to changes in altitude and precipitation. High alpine meadow occurs above a shrub community zone, with gradual transition to semi-arid steppe. Dominant genera include Agropyron, Festuca, Bromus, Quercus, Juglans, Cornus, Rosa, Rhus, Ribes, Juniperus, Tamarix, Astragalus and Artemisia. Floristically, there is a Mediterranean influence from the west and from the warm, humid Colchic district to the north west and of Caucasian plants from the north. Towards the east there is a distinct link to the Caspian forest region. In addition, there are many similarities with the Central Iranian arid zone.

FAUNA The reserve is noted for high densities of brown bear Ursus arctos and wolf Canis lupus. Lynx Lynx lynx, red deer Cervus elaphus, Persian wild goat Capra aegagrus, argali Ovis ammon and wild boar Sus scrofa are also common. The bird fauna is varied, reflecting the combination of caucasian, european woodland and mountain influences. The reserve is the only habitat in Iran of Caucasian black grouse Tetrao mlokosiewiczi and ring-necked pheasant Phasianus colchicus. Other birds include Caspian snow cock Tetraogallus caspius and black partridge Francolinus francolinus. Of the European woodland species reaching Iran, bullfinch Pyrrhula pyrrhula is restricted to the reserve.

CULTURAL HERITAGE The upland area has not undergone a great deal of settlement or use by man.

ZONING/CONSERVATION MANAGEMENT Hunting is severely restricted and grazing or tree cutting subject to regulations.

STAFF 42 full-time staff

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There are studies of the Caucasian black grouse and other bird species, with special attention to predator-prey relationships. No special facilities exist.

LOCAL POPULATION The area has a low population density.

DISTURBANCES, DEFICIENCIES MANAGEMENT PROBLEMS There is scattered upland wheat farming and woodcutting for local use. The highland shrub communities are little modified and currently well protected.

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Arjan Protected Area

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Totally

DATE ESTABLISHED The area was established in March 1972. Two wetlands within it were designated as Lake Parishan and Dasht-e-Arjan Ramsar site on 23 June 1975. It was accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION On the south-west flank of the Zagros Mountains, 70km west of Shiraz, 30°00'N, 52°12'E.

ALTITUDE 853-3,041m

AREA 65,750ha

LAND TENURE Government

PHYSICAL FEATURES The landforms are varied, including escarpments, hilly areas, salt flats and lakes. Geologically, the area is characterized by Oligo-Miocene limestone formations with alluvial deposits in the basins. Lake Parishan, a saline lake, has a catchment of approximately 29,000ha, with a

lake surface of about 4,000ha. Associated with the lake are small fresh to brackish marshes of about 200ha. Arjan lake, a freshwater lake, reaches 1,950 ha in size. By late summer, the Arjan lake is reduced to several hundred hectares due to the waters of the lake being drained by swallow-holes. The Arjan lake marshes form a permanent area of around 400ha. Temperatures vary with altitude. The Arjan lake area is characterized by cold winters (-10 to -15°C) and mild summers (15-35°C). Parishan lake area is typified by winter temperature extremes of 5-15°C and summer temperatures from 22-40°C. Mean annual precipitation is between 400 and 500mm, mainly from winter rains and snowfall.

VEGETATION Due to the wide range of elevation and environments a large diversity of plant formations occur. Halophytic vegetation, consisting particularly of various genera of Chenopodiaceae (Salsola, Kochia, Camphorosma and Halocnemum) predominates around Lake Parishan. Forest remnants, consisting primarily of Quercus persica, exist in the montane area. Elsewhere, up to an elevation of 2,400m, a light xerophilous forest predominates, consisting of Quercus spp., Amygdalus spp., Crataegus spp., Prunus spp., Celtis spp. and Pyrus spp.. Below 1,400m vegetation is steppic, with shrubs predominating. The freshwater marsh vegetation consists chiefly of Phragmites spp., Typha spp. and Juncus spp..

FAUNA The two lakes are particularly important for waterbirds but there are also many mammals in the area. Special attention has been given to the reintroduction of the Asian lion Panthera leo persica (E) which occurred in the area until about a hundred years ago. Argali Ovis ammon, Persian ibex Capra aegagrus, wild boar Sus scrofa, leopard Panthera pardus (V) and wolves Canis lupus (V) are common in the area. Among the small predators, jackal Canis aureus, red fox Vulpes vulpes, striped hyaena Hyaena hyaena, jungle cat Felis chaus, rock marten Martes foina, common Indian mongoose Herpestes edwardsi, caracal Felis caracal, wild ass Equus hemionus, Persian gazelle Gazella sp. and badger Meles meles occur in varying degrees. The Syrian brown bear Ursus arctos syriacus is an important inhabitant of the area and widely protected. The reserve contains an impressive number of bird species, particularly terrestrial avifauna. Winter populations of wildfowl may be as high as 250,000 depending on marsh and weather conditions. There are large concentrations of greater flamingo Phoenicopterus ruber, pintail Anas acuta, mallard A. platyrhynchos, teal A. crecca, pochard Aythya ferina, coot Fulica atra and crane Grus grus. Although breeding populations of marbled teal Anas angustirostris, purple heron Ardea purpurea, spoonbill Platalea leucorodia, glossy ibis Plegadois falcinellus, black-necked grebe Podiceps nigricollis, great crested grebe P. cristatus, little bittern Ixobrychus minutus and white-headed duck Oxyura leucocephala are small these species are relatively rare and do not breed in large numbers anywhere in Iran. In wet years, the lakes are important breeding areas for dalmatian pelican Pelecanus crispus (V) and Baillon's crake Porzana pusilla.

ZONING/CONSERVATION MANAGEMENT At present the policy is to end human settlement, grazing and agriculture. Limited tourist facilities are planned.

STAFF 44 full-time staff

LOCAL ADMINISTRATION The Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES None

SCIENTIFIC RESEARCH AND FACILITIES Special studies are being conducted by the Department of the Environment. Birds have been censused annually since 1969. A research station (for the Southern Region) is located in Shiraz.

LOCAL POPULATION A number of people live in the reserve, mainly involved with agriculture, particularly pastoral farming although some wheat is grown near Lake Perisham, and in the west of it there are some fishing ponds.

MODIFICATION OF THE NATURAL ENVIRONMENT There has been much disturbance in the past. Human settlement, grazing and agricultural practices are currently being phased out.

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Geno Protected Area

BIOGEOGRAPHICAL PROVINCE 2.20.08 (Anatolian-Iranian Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1973 as a National Park and accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION Southern Iran, 27°30'N, 56°21'E

ALTITUDE 50-2,347m

AREA 49,000ha

LAND TENURE Government

PHYSICAL FEATURES The area is dominated by a single mountain and its associated ridges rising above the Persian Gulf Plain. Several hot springs are located in the valleys. Erosion has resulted in the formation of deep canyons cutting into the uplifted mountains, creating great microclimatic

variation. Summer temperatures average 35-40°C on the Persian Gulf Plain and 17°C on the top of Geno Mountain. Annual precipitation is between ten and 120mm.

VEGETATION Geno Mountain shows an interesting climate-vegetation relationship with changes in elevation. Juniperus polycarpus, Olea aucheri, Pistacia mutica, P. khinjuk, Acer cinerascens, Daphne angustifolia, Euphorbia lanica; species of Prunus, Amygdalus, Fraxinus, and Acacia are unique to the reserve.

FAUNA Geno has a great diversity of birdlife, since it is situated in the Palearctic and Oriental transition zone and exhibits such a diversity of bioclimatic zones. Typical large mammals include goitred gazelle Gazella subgutturosa, Persian ibex Capra aegagrus, striped hyaena Hyaena hyaena, wild sheep Ovis ammon, wolf Canis lupus and jackal Canis aureus.

ZONING/CONSERVATION MANAGEMENT Hunting an exploitation of the vegetation are restricted by regulations.

STAFF Ten full-time staff

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran, Iran.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Studies are being conducted by the Environmental Research Centre of the Department of the Environment. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT A microwave communication station is located at the top of Geno Mountain. Limited charcoal production occurs in reserve area.

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Golestan National Park

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1956 this area was entrusted to the Game Council of Iran and on 10 August 1957 became the Alweh and Ishaki Protected Region. Other name and boundary changes occurred until an area of 91,890ha became the Mohammed Reza Shah Wildlife Park on 11 April 1964. A larger area was accepted as a Biosphere Reserve in June 1976. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION At the eastern end of the Alburz Mountains in north-east Iran 400km north-east of tehran, about midway between the cities of Goubad, Kabus and Bojnoord, 37°31'N, 56°35'E.

ALTITUDE 380-2,410m

AREA 125,895ha

LAND TENURE Government

PHYSICAL FEATURES The park is mountainous, particularly in the south-west third but relief decreases towards the east. Terrain varies from extremely rugged areas of limestone cliffs to level or slightly undulating terrain. Situated on the divide between the Caspian Sea and the arid interior, the climate varies within the park from extremely wet in the west to moderately arid in the east. Annual rainfall varies year and by area from over 1000mm to less than 200mm. Temperatures range from -35°C to 35°C.

VEGETATION The vegetation has remained relatively undisturbed. In the humid eastern portion of the park, a climax temperate rainforest predominates with chestnut-leaved oak Quercus castanaefolia, persian ironwood Parrotia persica, hornbeam Carpinus betulus, Zelkova crenata, and species of Alnus, Fraxinus and Tilia below 1,800m. Caucasian oak Quercus macranthera and species of Sorbus, Acer and Juniperus are common higher up. Towards the east the Caspian influence dominates and forest gives way to scrub and then to lush steppe and a variety of shrubs and grasses occur, including many species of Artemisia, Astragalus, Acantholimon, Agropyron, Stipa and Bromus. Many of the grasses and forbs are annuals.

FAUNA The variety of habitats causes a great variety of species and the relatively undisturbed nature of the area has meant that many of these are very abundant. Wild sheep Ovis ammon are the most numerous large animals, with herds of up to 500 on the maritime steppe and a total of over 15,000 animals. In the forest there are many wild boar Sus scrofa. Red deer Cervus elaphus and roe deer Capreolus capreolus browse in fields where a variety of birds can be seen: ring-necked pheasant Phasianus colchicus, woodcock Scolopax rusticola, quail Coturnix coturnix and wood pigeons Columba palumbus. The abundance of animals sustains a large number of predators such as leopard Panthera pardus (V), jungle cat Felis chaus, jackal Canis aureus, brown bear Ursus arctos and stone marten Martes foina. On the south-eastern plains, small herds of goitred gazelle Gazella subgutturosa can be seen as well as all four species of Iran's vultures: black vulture Aegypius monachus, griffon vulture Gyps fulvus, Egyptian vulture Neophron percnopterus and lammergeier Gypaetus barbatus. In high sub-alpine areas Caspian snowcock Tetraogallus caspius occurs.

CULTURAL HERITAGE Before the beginning of the Pahlari Dynasty in about 1913, inter-tribal conflicts made this area too dangerous for habitation or even grazing. The area was therefore little disturbed until 1913, after which land use steadily intensified.

ZONING/CONSERVATION MANAGEMENT No intrusion, except the already existing Asian highway, is allowed. Wild boar are so numerous as to allow sport and commercial cropping. The park is managed so as to preserve its largely untouched state and biological research is encouraged. There have been a number of five-year plans and the 1979-1984 plan included the re-routing of the Asian highway.

STAFF 60 full-time staff

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES In 1975 there were 2500 visitors per day in summer and a ten-fold increase was expected within five years.

SCIENTIFIC RESEARCH AND FACILITIES Studies have been conducted by the Environmental Research Centre of the Department of the Environment. There are no special facilities but a research station is planned.

LOCAL POPULATION The reserve has received little impact from the local population who are mainly pastoralists, and now excluded by law.

MODIFICATION OF THE NATURAL ENVIRONMENT Construction of the Asian Highway has impaired the central portion of the reserve, requiring extensive rehabilitation, but it is hoped that this highway will be relocated in the course of the sixth five-year plan (1979-84).

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Hara Protected Area

BIOGEOGRAPHICAL PROVINCE 2.20.08 (Anatolian-Iranian Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED The Hara Protected Region of 65,750ha was established in 1972. On 23 June 1975 it was included in the 100,000ha Ramsar site and a slightly smaller area than this was accepted as a Biosphere Reserve in June 1976. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION In straits of Khuran, Persian Gulf, between Qeshm Island and the southern Iranian coast, Bandar Abbas province, 26°45'N, 55°40'E.

ALTITUDE 0-173m

AREA 85,686ha

LAND TENURE Government

PHYSICAL FEATURES Much of the reserve is taken up by the Mehran delta which forms extensive intertidal flats and has a marshy coastline. There are numerous small islands, creeks and minor estuaries. The climate is subtropical and summers are extremely hot with temperatures reaching 45°C. Rainfall is low with an annual total of 100-300mm, mainly falling from November to April.

VEGETATION The reserve contains the largest stand of Avicennia spp. mangrove along the Persian Gulf Coast shoreline. Inland, the salt plain consists of open communities of Zygophyllum spp., Anastatica spp. and Centaurea spp., with denser shrub vegetation and annuals occurring in sandy localities with Prosopis spp., Stipa spp. and Acacia spp.

FAUNA This area is of major importance to breeding, wintering and migrant waterbirds. Many herons breed, including great white egret Egretta alba, western reef heron E. gularis, Indian pond heron ardeola grayii and goliath heron Ardea goliath. Crab plover Dromas ardeola and stone curlew Burhinus oedicnemus also breed here. Migrant birds include grey heron Ardea cinerea, redshank Tringa totanus, terek sandpiper T. cinereus, bar-tailed godwit Limosa lapponica and curlew Numenius arquata. Flocks of dalmatian pelican Pelecanus crispus (V), spoonbill Platalea leucorodia and greater flamingo Phoenicopterus ruber overwinter here. The green turtle Chelonia mydas (E) occurs in significant members. Porpoises Phocaera phocaera have been observed regularly off Qeshm Island while whales are seen less frequently.

ZONING/CONSERVATION MANAGEMENT Mangrove cutting for making charcoal has largely been controlled but some persists, particularly in the east.

STAFF Ten full-time staff

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Studies have been conducted by the Environmental Research Centre of the Department of the Environment, and censuses made of waterbirds. There are no special facilities but a marine research station has been set up on Hormoz Island, to the east of the reserve.

LOCAL POPULATION People living along the coast still cut mangroves and carry out fishing in the straits.

MODIFICATION OF THE NATURAL ENVIRONMENT Mangrove cutting for charcoal persist to the east and there is some disturbance in the straits from fishing and boat traffic.

PRINCIPAL REFERENCE MATERIAL

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Kavir National Park

BIOGEOGRAPHICAL PROVINCE 2.24.08 (Iranian Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established on 20 June 1964 as a Protected Region, created a Wildlife Park in 1971 and accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION On the north-east slopes of the Zagros mountains, 170km south-east of Tehran, 34°16'N, 53°07'E.

ALTITUDE 609-2,015m

AREA 700,000ha

LAND TENURE Government

PHYSICAL FEATURES The park includes an extensive area of desert with a great variety of landforms. At low elevations there are salt pans and sand dunes. The foothills are composed of Miocene and more recent limestone while in higher areas there are extrusive igneous rocks, which cause a rugged relief in some places. Soils are generally depleted through past over-use. Rainfall is low, on average 100mm per annum and highly variable from year to year. Most falls as light rain from November to May. Mean monthly temperatures range from 15°C to over 40°C.

VEGETATION In times of drought, the more resistant shurbs and perennial herbs are confined to water courses, but sufficient rains cause a profuse growth of annuals and other herbs. In the areas characterized by more than 100mm mean annual precipitation, such genera as Artemisia, Astragalus, Pteropyrum, Zygophyllum and Amygdalus occur. Vegetation varies according to soils, with Haloxylon ammodendron and Aristida spp. predominant on the lighter soils and such genera as Alhagi, Suaeda, Seidlitzia and Tamarix on the saline soils.

FAUNA The typical desert fauna is well represented. Mammals inlcude mountain gazelle Gazella gazella, goitred gazelle G. subgutturosa, red fox Vulpes vulpes, cheetah Acinonyx jubatus, caracal Lynx caracal, wild ass Equus hemionus (one of the few viable populations in Iran), argali Ovis ammon and Persian ibex Capra aegagrus. Many Palearctic birds occur including houbara bustard Chlamydotis undulata.

ZONING/CONSERVATION MANAGEMENT The area was upgraded from a protected region to a wildlife park in 1971 so that culling and cropping can only be carried out be licence or authorised personnel. The vegetation has since recovered considerably from overexploitation.

STAFF Eleven full-time personnel

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES None

SCIENTIFIC RESEARCH AND FACILITIES Special studies have been conducted by the Environmental Research Centre of the Department of Environment. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT There are two mines in full operation in 1976 which may still exist. The vegetation was degraded n the past through over exploitation by man, not helped by the unreliable rainfall. Lack of vegetation has meant that some of the foothills are dissected by erosion gulleys. However, with added protection, the vegetation has recovered considerably.

PRINCIPAL REFERENCE MATERIAL

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Lake Oromeeh National Park

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established as Lake Rezaiyeh Protected Region on 29 August 1967, an expansion of the protected area, previously limited to one island in the lake, Gkoyoon Daghi which was made a protected region on 19 February 1960. The area was upgraded to a wildlife reserve in 1972 and Oromeeh National Park was created, with a slightly smaller area, in August 1967. The national park was designated a Ramsar site on 23 June 1975 and accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION About 70km south-west of Tabriz, Azarbaijan Province, in north-western Iran, 37°00'-38°12'N, 44°40'-45°50'E.

ALTITUDE 1,126-1,526m

AREA 462,600ha

LAND TENURE Government

PHYSICAL FEATURES The park comprises Lake Oromeeh, formerly Lake Rezaiyeh, the largest inland body of water in Iran, and the 52 islands in it. The lake is extremely saline with salt contents fluctuating between 8% and 28% annually. Around the shores are salt flats and marshes. The lake is situated in an area of gently sloping alluvial and gravel plains, fed partly by streams from the Zagros mountains 30km to the west. Most of the islands are small but the largest, Ghoyoon Daghi, now called Kabudan, comprises 3,125ha of hilly terrain. Annual precipitation is low, varying between 400mm and 600mm. Temperatures range from -17°C to 36°C, causing high evaporation rates in the dry summers.

VEGETATION The natural vegetation has largely been lost, except on the island in the lake where viable remnants exist, including pistachio forest Pistacia atlantica. The islands also have steppe, dominated by Artemisia spp. Around the lake shore, salt flats stretch for several hundred metres. Beyond this, low vegetation dominated by Chenopodiaceae grows, and there are brackish marshes with typical communities of rushes Juncus spp. and reeds Phragmites communis.

FAUNA The lake is of primary importance to waterbirds. There are large breeding colonies of greater flamingo Phoenicopterus ruber, white pelican Pelecanus onocrotalus, common shelduck Tadorna tadorna, ruddy shelduck T. ferruginea, spoonbill Platalea leucorodia, herring gull Larus argentatus and slender-billed gull L. genei. It is also an important site for migrant and wintering waders (Charadriidae and Sclolpacidae), herons (Ardeidae) and ducks, including pintail Anas acuta, teal A. crecca, mallard A. platyrhynchos and coot Fulica atra. There are no fish in the lake as it is so saline but there are high densities of brine shrimp Artemia salina in summer and algae Enteromorpha intestinalis. Kabudan island has about 800 argali of the Armenian race Ovis ammon gmelini and a higher density of chukar Alectoris chukar than any other reserve in Iran.

ZONING/CONSERVATION MANAGEMENT The area is managed as a nature reserve and nesting birds are fully protected.

STAFF 19 full-time staff

LOCAL ADMINISTRATION The Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES Recreational use of the lake is poorly developed.

SCIENTIFIC RESEARCH AND FACILITIES The flamingo and pelican populations have been studied and regular waterbird censuses are made by the Department of the Environment. There are no special facilities.

LOCAL POPULATION There are several small villages on the lake shore and the town of Tabriz is 70km away.

DISTURBANCE, DEFICIENCIES AND MANAGEMENT PROBLEMS A tug and lighter transport cattle between five jetties on the lake shore. The area protected does not include a great area of the lake's shore. Recreational use is poorly developed but any expansion will need carefull planning. There is some threat of pollution from the towns of Tabriz and Rezaiyeh.

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Miankaleh Protected Area

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Totally

DATE ESTABLISHED Miankaleh Protected Region was established in 1970, covering 97,200ha. On 23 June 1975 an area of 100,000ha was designated as a Ramsar site but reduced to 40,000ha. The area below was accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran

requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION In the extreme south-east corner of the Caspian Sea, including Miankaleh Peninsula and adjacent Georgan Bay, 36°57'N, 54°01'E.

ALTITUDE 15-28m below sea level (Caspian sea level being -28m)

AREA 68,800ha

LAND TENURE Government

PHYSICAL FEATURES Gorgan Bay is separated from the Caspian Sea by the Miankaleh peninsula, a bay bar capped with sand dunes, except in the east where a 12km wide channel connects the two water bodies. The bay is shallow, oligotrophic and saline, with salt contents between 10% and 12%, and has a sandy or muddy bottom. Along its southern and eastern (landward) shores are extensive marshes which are flooded in winter. These are eutrophic, due to inflow from numerous freshwater streams and irrigation channels. Annual precipitation varies considerably, from 200mm to 1000mm and mean monthly temperatures range from -9°C to 34°C.

VEGETATION The vegetaton fringing the bay is predominantly glasswort Salicornia spp. with some reeds Phragmites communis, sedges Carex spp., rushes Juncus spp. and Tamarix spp.. Some of the dunes on the Miankaleh peninsula are vegetated with scrub including pomegranite Punica sp..

FAUNA This area is important for over a quarter of a million wintering waterbirds, and is the main site on the Caspian for wintering greater flamingo Phoenicopterus ruber, dalmatian pelican Pelecanus crispus (V), greylag goose Anser anser, lesser white-fronted goose A. erythropus, and red-breasted merganser Mergus serrator. The rare white-headed duck Oxyura leucocephala also winters here. Breeding birds are most numerous in years of high rainfall.

ZONING/CONSERVATION MANAGEMENT The area is managed as a nature reserve. A management plan was outlined in 1974 but there was no information on its implementation in 1980. A habitat manipulation programme was underway in the 1970s and the possibility of an enclosed refuge for fallow deer Dama mesopotamica was being studied.

STAFF Fourteen full-time staff

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The Northern Fisheries Organization (SHILOT) have carried out limnological and hydrobiological studies. The Environmental Research Centre of the Department of the Environment have studied bird migration and carried out regular censuses of waterbirds. There are no special facilities.

LOCAL POPULATION There are several small villages on the southern and eastern shores of the bay where wheat and cotton is cultivated with irrigation. The inhabitants fish within the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Reed cutting and fishing occur within the protected area and grazing occurs inland, as there are some inholdings. Irrigation schemes planned may reduce the amount of freshwater flowing into the bay. There is a fish processing factory not far away at Ashuradeh. A nuclear power station is planned to be sited just to the west of the area.

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Touran Protected Area

BIOGEOGRAPHICAL PROVINCE 2.24.08 (Iranian Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1973 as a Wildlife Reserve and Protected Area and accepted in June 1976 as a Biosphere Reserve. Constitutional Act No. 50 of the Islamic Republic of Iran requires citizens to honour the conservation of nature and natural resources. In March 1972 the Department of Environment was established with legal duties for environmental preservation.

GEOGRAPHICAL LOCATION In north-east Iran, at the base of the Alburz Mountains. 36°25'N, 57°05'E.

ALTITUDE 600-2,281m

AREA 1,000,000ha

LAND TENURE Government

PHYSICAL FEATURES The extensive desert plains, part of the great Dasht-e-Kavir, drain into a vast salt pan lake occupying a portion on the southern boundary of the reserve. Gypsum-containing marls, limestone outcrops, and rocky soils characterize the area. Average precipitation is low (100mm) and variable according to winter moisture patterns. Temperatures range from -10°C to over 40°C.

VEGETATION The vegetation is highly influenced by pastoral activities with much of the grass component missing. Excellent stands of Zygophyllum spp. along with Artemisia spp. and Astragalus spp. communities are found: Haloxylon spp., Acantholimon spp., Hordeum spp. and Lactuca spp. are well represented.

FAUNA Touran Wildlife Refuge is one of the major remaining strongholds of a viable population of the Persian wild ass Equus hemionus (about 750). Other notable species recorded for the area include caracal Lynx caracal, striped hyena Hyaena hyaena, cheetah Acinonyx jubatus (V) and leopard Panthera pardus (V). Goitred gazelle Gazella subgutturosa, dorcas gazelle G. dorcas and argali Ovis ammon are present.

ZONING/CONSERVATION MANAGEMENT Hunting is severely limited by licence and there are restrictions on grazing and tree cutting.

STAFF Twenty-seven full-time personnel

LOCAL ADMINISTRATION Department of the Environment, PO Box 1430, Tehran.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The arid zones research group and the Division of Wildlife, both of the Department of the Environment, are conducting land-use and ethnological studies for the development of land-use models in the arid reserves. It has been selected as a site for long-term research on the impact of grazing by domestic livestock and on competition between wild and domestic herbivores, and a research station is proposed.

LOCAL POPULATION The area is fairly well populated, with numerous villages and pastroalism is a major occupation.

MODIFICATION OF THE NATURAL ENVIRONMENT The area is populated by pastoralists, and overgrazing has occurred, so that much of the natural grass cover is missing. This problem is not helped by the erratic rainfall.

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North Bull Island

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Total

DATE ESTABLISHED A larger area was established as a bird reserve in 1931 under the Wild Bird Protection Act and further protected under the Wildlife Act and Planning Act 1975. The Biosphere Reserve was accepted in 1981.

GEOGRAPHICAL LOCATION The island is situated in Dublin Bay. It is connected to the mainland by a bridge at the southern end and by a causeway midway along its western shore. 53°17'N; 06°05'W.

ALTITUDE Near sea level

AREA 500ha

LAND TENURE Dublin Corporation

PHYSICAL FEATURES This island has developed from a sand bar which was created as a result of the building of the North Bull Wall at the start of the 19th century. This wall acts as a sediment trap for the post Pleistocene sands and gravels which are moved along shore by currents. It consists of a 5km long series of sand dunes backed by salt marshes and mudflats, and includes offshore waters to the east. A dune successional complex, dune slack marsh, salt marsh with well-defined zonation and fringing intertidal mud and sand flats have developed. Mean annual precipitation is 630mm at an altitude of 10m.

VEGETATION There is typical salt-marsh vegetation with well-defined zonation, and marsh plants in the dune slacks.

FAUNA A site of international significance under the Ramsar Convention, but it is not so designated yet. Together with the rest of Dublin Bay, it is a major European sanctuary for migrants. The 400-600m wide tidal channel between the island and mainland is particularly important for waterbird feeding. The North Bull harbours 10% of the total Irish wintering population of bar-tailed godwits Limosa lapponica. It is an important natural site for some duck species, such as wigeon Anas penelope (2000), teal A. crecca, shelduck Tadorna tadorna (800), pintail A. acuta (400), shoveler A. clypeata (200), and is of international importance for the Greenland race of brent geese Branta bernicla hrota (600). The island is noted for its population of Lepus timidus hibernicus, its saltmarsh invertebrates which number 329 species, and its insects and arachnids, of which 420 species have so far been identified.

CULTURAL HERITAGE The area is of relatively recent origin, having developed after the building of a seawall in the early 1800s.

ZONING/CONSERVATION MANAGEMENT No agreement has yet been reached on zoning, but probably the dune slack area and the developing dune spit will be two of the core areas, being 20 and 30ha approximately. The rest of the reserve is zoned for recreational use. The area is managed as a nature reserve, apart from recreational use primarily along the beach.

STAFF One warden

LOCAL ADMINISTRATION Dublin Corporation, City Hall, Dublin 2.

VISITOR FACILITIES The reserve can be reached by car or bus from Dublin in 20 minutes, being about 5km away. On the island there are also two private golf courses and the area is used for swimming and walking.

SCIENTIFIC RESEARCH AND FACILITIES The salt marsh succession is now well studied, one interesting environmental feature being observation of hypersaline episodes when soil salinity is twice that of sea water. There has been research interest in the island since 1900 and studies have been undertaken on pollution and water quality, sedimentation rates, algal growth, ornithology and ecological succession.

LOCAL POPULATION The city of Dublin is only 5km away, and the reserve is used alot for outdoor education by local schools.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve is heavily used for recreation, primarily swimming and walking. The area contains two private golf courses, but apart from these areas the vegetation is in a natural state. Attempts by Dublin Corporation to fill in part of the salt marshes have been forestalled by NGOs.

PRINCIPAL REFERENCE MATERIAL

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Killarney National Park

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Total

DATE ESTABLISHED 4,272ha in 1932, under the Bourn-Vincent Memorial Park Act; the remainder acquired under the State Property Act 1954. Accepted as a Biosphere Reserve in 1982.

GEOGRAPHICAL LOCATION Southwest Ireland, just south-west of Killarney, county Kerry; 52°01'N, 9°35'W.

ALTITUDE 22-842m

AREA About 8,308ha, including 2,249ha of lakes

LAND TENURE Government

PHYSICAL FEATURES The park is situated in part of the Laune river valley and includes several loughs along its course. There are two major rock types. In the south and west there is Devonian old red sandstone while to the east and north of Lough Leane is younger Carboniferous limestone. The sandstone area has rugged, mountainous scenery with hills generally between 500m and 700m while the limestone rocks are more easily eroded, particularly by solution, and form a lowland area. The basin of Lough Leane was partly formed by

solution, and the fretted cliffs and caverns along its shores are evidence of this process continuing. Quaternary glaciation deepened the valleys in the vicinity of Upper Lake, steepened slopes and formed corries like the Devil's Punchbowl on Mangerton Mountain. The valleys have a thin layer of drift which is more extensive on the north-east shores of Lough Leane. Soils on the sandstone are acid, sandy and sometimes deep, particularly in poorly drained areas where peat has formed. Soils on limestone are shallow and sometimes bare rock is exposed. The climate is oceanic, with a high rainfall of 1708mm per year at Muckross but 3200mm on the slopes of Mangerton. There is a small range of temperature between the February mean of 6.0°C and July-August mean of 15.2°C at Muckross.

VEGETATION Much of the natural woodland has been cleared but the remaining fragments include the most extensive areas in the country. On the sandstone are woods of sessile oak Quercus petraea with holly Ilex aquifolium in the understorey. On the Muckross peninsula there is a yew Taxus baccata wood growing on almost bare limestone while carr forest dominated by Alnus glutinosa grows in places along the north-east shore of Lough Leane and in other poorly-drained areas. Most of the park is covered by low-growing bog and heath, the former in poorly drained areas, dominated by bog moss Sphagnum spp. with sundew Drosera sp. and larger flowered butterwort Pinguicula grandiflora. There are a number of alpine plants which occur at low level, including hair grass Deschampsia alpina, alpine sawwort Saussurea alpina and clubmoss Lycopodium alpinum. A number of plants here have very disjunct distributions. The strawberry tree Arbutus unedo is otherwise found in mediterranean areas while some plants have grown also in Spain and Portugal, but not between: Irish spurge Euphorbia hyberna, large-flowered butterwort Pinguicula grandiflora, kidney saxifrage Saxifraga hirsuta and St. Patrick's cabbage S. spathularis. The oakwoods are notable for the abundance of ferns and bryophytes, including the rare bristle fern Trichomanes speciosum and a number of filmy ferns Hymenophyllum spp., due to their high hummidity and rainfall.

FAUNA The only native herd of Irish red deer Cervus elaphus live in the park, including a small lowland herd and a mountain herd of at least 380 (1982). There are also about 1,000 introduced sika deer C. nippo, and a small herd of feral goats Capra hircus on Torc mountain. Most species of native mammal are common, including red squirrel Sciurus vulgaris and bank vole Chrionymus glareolus, the latter near its southern limit. Birds include 114 recorded species, of which 64 breed, including peregrine Falco peregrinus. Wintering birds include about 140 white-fronted geese Anser albifrons. A freshwater subspecies of the sea fish the twaite shad Alosa fallax and the more usually sub-arctic blunt-nosed char Salvelinus obtusus occur in the lakes. The invertebrate fauna is varied and interesting. The kerry spotted slug Geomalacus maculosus is otherwise found in Spain and Portugal and the glass snail Semilimax pyrenaicus has the other part of its range in the Pyrenees. A number of other species have their main distributions in Scandinavia or the Alps, including the northern emerald dragonfly which, together with the downy emerald dragonfly is found nowhere else in Ireland. One minute fly Buchonomyia thienemanni is only known from two other localities in the world.

CULTURAL HERITAGE There is evidence of Bronze Age human settlement at Ross Island where the discovery of stone hammers indicates that copper was mined there. The only other known prehistoric human occupation in the park is indicated by a souterrain on the shore of Muckross Lake. In the seventh century a monastery was founded on Innisfallen Island in Lough Leane, reputedly by St. Finian. The existing ruins include a twelth century oratory with a Romanesque doorway. Later, the land in this area belonged to the

O'Donoghues, whose chieftain reigned at Ross Castle on the shores of Lough Leane; the ruins of this today include a mediaeval tower. In about 1448, Muckross Abbey was founded for Franciscan friars and later became the burial place for many notable local people; its remains are well-preserved. In the 18th and 19th centuries mining arose in the area from time to time and some workings are still in evidence. More impact was made by the felling of timber for smelting and the introduction of economic forestry. Recently, the Muckross Estate was bought in 1910 by Mr W.B. Bourn as a wedding gift for his daughter Maud to Arthur Vincent and later given to the nation in her memory as the Bourn Vincent Memorial Park.

ZONING/CONSERVATION MANAGEMENT Three areas can be recognised; a nature conservation area comprising most of the park, where intervention in natural processes is kept to a minimum; cultural landscapes (about 500ha) where the main tourism/recreation amenity area is located and cattle grazing is permitted; and about 450ha of forestry plantations. A management plan was being proposed in 1984. Throughout most of the park, intervention in natural processes is kept to a minimum. As visitor access is unrestricted, this is upheld by a number of bye-laws and discouraging use of sensitive areas. Introduced rhododendron Rhododendron ponticum has spread rapidly and a control programme is underway. Regular anti-poaching patrols and limited burning to encourage new regrowth of moorland vegetation has increased the red deer population.

STAFF Park superintendent, assistant superintendent, zoologist and 79 staff

LOCAL ADMINISTRATION Park Superintendent, Killarney National Park, Muckross, Killarney, Co. Kerry.

VISITOR FACILITIES Muckross House is the focus for visitors, with displays, shop, craft demonstrations and various edcuational activities. It has fine ornamental gardens and an arboretum. Another major tourist attraction is Killarney Demesue, which has pleasant walks and an information centre. There are four self-guiding nature trails in the park and many information leaflets available. Cars may enter Muckross Demesue and there are many car parks at other points on the peripheral road. Alternatively, jaunting cars or bicycles can be hired. Boats are available for hire at several locations and fishing permits can be obtained. Accommodation is available in nearby Killarney.

SCIENTIFIC RESEARCH AND FACILITIES There have been studies of oak woodland, woodland and moorland phytosociology, bryophytes, rhododendron control, the native red deer, introduced sika deer, exclosure of herbivores, ecology of the bank vole Clethrionymus glareolus and wood mouse Apodemus sylvaticus, breeding birds, water chemistry, water pollution, primary and secondary productivity in lakes, ecology and taxonomy of aquatic invertebrates, palaeolimnology. Entomological collections have been made. Monitoring activities include weekly measurements of the water chemistry of Lough Leane, continuous monitoring of meterology and waterflow to and from the lakes, and annual measurement of plant response to exclosure from herbivores. There are limited laboratory facilities, and Knockreer House, near Killarney, is used for biological research.

LOCAL POPULATION Killarney House, within the park, is still privately owned. The park is just on the outskirts of Killarney.

MODIFICATION OF THE NATURAL ENVIRONMENT Killarney national park is one of the least modified parts of Ireland. Non-native species such as Rhododendron ponticum and Cervus nippon are invading native ecosystems, and wolf and eagle

have been extirpated. Some cattle grazing occurs. A limited area is used for afforestation. Eutrophication is a problem, especially in Lough Leane, due to pollution from the town of Killarney and local agriculture and industry. There is no perimeter fence, so trespassing sheep are difficult to exclude.

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Collemeluccio-Montedimezzo

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

GEOGRAPHICAL LOCATION This biosphere reserve, located in the Isernia (Molise) province, consists of two different topographical units:

A. Collemeluccio

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1971 as a Nature Reserve and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION The reserve is bordered on the west by the Trigno River, on the north by the Posta Valley and the Celano-Foggia path, and on the south by private properties and the Salcitaro Valley. 41°44'N, 14°15'E.

ALTITUDE 834-1,063m

AREA 187ha (The biosphere reserve has a total area of 478ha)

LAND TENURE Government

PHYSICAL FEATURES The underlying rocks are predominantly limestone with some Eocene clay, resulting in leached brown limestone or rendzina soils. The annual precipitation is about 970mm with 126 days of rain. The mean annual temperature is 19.7°C with a monthly maximum of 31.9°C and minimum of 10.3°C.

VEGETATION The reserve is noted for its magnificent forest of silver fir Abies alba, an exceptional relict of the former Apennine vegetation. Mixed forest of A. alba and turkey oak Quercus cerris the latter in the form of aged coppices also occurs.

FAUNA Mammals include wild boar Sus scrofa, badger Meles meles and wild cat Felis sylvestris.

ZONING/CONSERVATION MANAGEMENT The area is managed as a strict nature reserve and access only permitted for study purposes.

STAFF The Government Agency for State Forests is responsible for maintenance.

LOCAL ADMINISTRATION Azienda di Stato per le Foreste Domaniali, Ufficio Amministrazione Isernia, Via Dante Alighieri 13, 86170 Isernia, Italy.

VISITOR FACILITIES There are a few visitors but no special facilities exist.

SCIENTIFIC RESEARCH AND FACILITIES Much research is needed including detailed vegetation assessment. A meteorological station has been set up by the Instituto Sperimentale per la Selvicoltura. Some derilict buildings could be improved for accommodation and a service road through the reserve can be used by cars.

LOCAL POPULATION The surrounding area has few inhabitants.

MODIFICATION OF THE NATURAL ENVIRONMENT There has been uncontrolled grazing in the past and there is some tourism.

PRINCIPAL REFERENCE MATERIAL
Wirth, H. (1979). Nature Reserves in Europe. Edition Leipzig, Leipzig.

B. Montedimezzo

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1971 as a Nature Reserve and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION The reserve is bounded on the east by Monte Penna and Monte di Mezzo, on the west by the South Biagio Pass, on the north by the Frazzina Valley, the Celano Foggia path and the roads separating the reserve from the Molise District protected zone. The southern boundary is formed by forests partly owned by the commune and private persons. 41°35'N, 140°15'E.

ALTITUDE 922-1,284m

AREA 291ha

LAND TENURE Government

PHYSICAL FEATURES The underlying rocks are Eocene clay and limestone, the former more common in the central and north-east parts. These produce soils such as leached brown limestones and rendzinas. The climate is moderately cool, annual precipitation 1020mm, with 116 days of rain. Average annual temperature is 18.9°C; the annual maximum is 30.3°C and the annual minimum 13.5°C.

VEGETATION On the lower levels, vegetation consists of a forest of turkey oak Quercus cerris with coppices of hornbeam Carpinus betulus, medlar Mespilus germanica and field maple Acer campestre. On the middle levels Quercus cerris is mixed with medlar Fagus sylvatica, which gradually becomes dominant at higher altitudes.

FAUNA Mammals include wild boar Sus scrofa, badger Meles meles and wild cat Felis sylvestris.

ZONING/CONSERVATION MANAGEMENT The area is managed as a strict nature reserve and access only permitted for study purposes.

STAFF The Government Agency for State Forests is responsible for maintenance and supervision.

LOCAL ADMINISTRATION Azienda di Stato per le Foreste Domaniali, Ufficio Amministrazione di Isernia, Via Dante Alighieri 13, 86170 Isernia, Italy.

VISITOR FACILITIES There are a few visitors but no special facilities exist.

SCIENTIFIC RESEARCH AND FACILITIES There is little information on research. In the reserve there is a building which can house staff and equipment.

LOCAL POPULATION The surrounding area has few inhabitants.

MODIFICATION OF THE NATURAL ENVIRONMENT Quick-growing rees such as silver fir Abies alba and Pseudotsuga spp. prevent the regeneration of the turkey oak forest.

PRINCIPAL REFERENCE MATERIAL

Wirth, H. (1979). Nature Reserves in Europe. Edition Leipzig, Leipzig.

Foret Domaniale du Circeo

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED In 1934 as a Protected Forest and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION On the west coast of Italy, 90km south of Rome in the commune of Sabaudia, Latina province. The reserve is part of the Circeo National Park (8,400ha). 41°20'N, 13°35'E.

ALTITUDE 0-54m

AREA 3,260ha

LAND TENURE Government

PHYSICAL FEATURES The forest is situated in a low-lying area a few kilometres from the coast which was once a large area of marshland insterspersed with higher areas, known as the Pontine marshes. These have now largely been drained. Soils are sandy and tend to be podsolic but impermeable at depth, which leads to local flooding. Annual rainfall is about 900mm and average annual temperature 15.5°C.

VEGETATION There is mixed forest, the remnant of a vast area of forest which was interspersed with marshes. On dryer areas it is dominated by pedunculate oak Quercus pedunculatau, turkey oak Q. cerris and Hungarian oak Q. frainetto together with caucasian ash Fraxinus oxycarpa, common alder Alnus glutinosa and English elm Ulmus procera. Drainage has led to a more Mediterranean-type vegetation, including holm oak Q. ilex with undergrowth Pistacia leritisens, Phillyrea latifolia and Erica arboarea. Around the flooded ponds the vegetation is mostly caucasian ash Fraxinus oxycarpa, grey willow Salix cincerea, pedunulate oak and alder, typical of the Pontine marshes.

FAUNA Mammals include crested porcupine Hystrix cristata, several hundred wild boar Sus scrofa, badger Meles meles, polecat Mustela putorius, weasel M. nivalis and fox Vulpes vulpes. There are 230 bird species in the whole national park area, and the forest includes isolated colonies of green woodpecker Picus viridis and greater spotted woodpecker Picoides major.

CULTURAL HERITAGE The forest is one of the last remnants of the Pontine Forest which once covered vast areas along this coast, and has a marshy landscape rife with malaria. It was the mythical realm of the goddess Circeo who turned man into swine. From Roman times there have been attempts to drain the marshes but these were at completely successful until the 1930s. Timber extraction occurred during the Second World War.

ZONING/CONSERVATION MANAGEMENT None. The forest does, however, form one of the natural core zones of the National Park which contains it. Felling of trees and hunting are prohibited. Roe deer have been reared in enclosures for reintroduction into the park. Attempts are being made to restore the original vegetation. Damming of some of the drainage canals has restored winter flooding to some areas.

STAFF There are 80 staff assigned to protection and maintenance of the whole area of the national park.

LOCAL ADMINISTRATION Via Carlo Alberto 53, Sabaudia, Latina, Italy.

VISITOR FACILITIES There has been a rapid development within the national park, but outside the forest reserve, holiday accommodation and facilities in the town of Sabaudia. There are two roads through the forest area and some paths, but access is generally limited, by permit only. There is a museum and reception centre at Sabaudia. The national park, but not necessarily the forest reserve, receives about 40,000 visitors a year, being fairly near Rome and with a long sandy beach.

SCIENTIFIC RESEARCH AND FACILITIES The flora has been surveyed. Permission for access for scientific purposes is obtainable and accommodation available in Sabaudia. Roads run through the forest and there is a series of paths.

LOCAL POPULATION This area has a fairly high rural population and over 8,000 people live in Sabaudi, on the southern edge of the forest.

MODIFICATION OF THE NATURAL ENVIRONMENT In 1959 the State Administration published a management report which stated that the forest needed tidying up. Therefore 22,000ha were cleared of stumps and bushes, 9km of drains dug, pods filled in, 15km of roads dug and 1,200ha afforested with exotic trees (Lovari and Cassola, 1975). Steps have now been taken to reverse these measures. The newly-constructed town of Sabaudia is less than a kilometre from the forest, and there is a fashionable resort a little further south on Mount Circeo.

PRINCIPAL REFERENCE MATERIAL

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Miramare Marine Park

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

AREA Declared a National Park on 31 May 1973. Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION In the extreme east of Italy, next to the town of Prosecco in the province of Trieste. 45°42'N, 13°42'E.

ALTITUDE -18m-40m

AREA 60ha, of which half is terrestrial and half marine

LAND TENURE Government

PHYSICAL FEATURES The reserve includes coastal cliffs and shingle beaches and a sea bed largely composed of muds and clays. Average annual mean sea temperature is 14.8°C; maximum 24.5°C, minimum 9.4°C. The average annual rainfall is 1,038mm. The pH of the sea in the area is from 7.7 to 8.3 with a salinity of 3.4% to 3.8%.

VEGETATION The terrestrial area has a typical Mediterranean sclerophyll vegetation. Submarine meadows consist of Posidonia oceanica, Zostera marina and Cynodocea nodosa. The intertidal zone has a unique Mytilus-Fucus virsoides association which is elsewhere endangered by hydrocarbon pollution and chemical pollutants. Fucus virsoides occurs only in this area of the northern Adriatic.

FAUNA The marine area has a rich fauna characteristic of a marine-estuarine environment. This area contains one of the last and the most northern station of the rare mollusc Conus mediterraneus. Mytilus galloprovincialis also occurs here. Several species have been reintroduced into the area, including Labrax lupus, Mugil sp., Crangon crangon and Maja squinado. The terrestrial area has a rich avifauna.

ZONING/CONSERVATION MANAGEMENT The reserve is naturally divided into roughly equal marine and terrestrial sectors. Around the sea area is a primary sector of 240m of coastline where fishing is prohibited and a zone of one mile where there is biological protection. Access to the marine area is restricted, to boats going to the port of Miramare only. The Merchant Navy assists in patrolling this area. Protection has enabled many marine species to increase their populations, and fishing and use of most motor boats is prohibited.

STAFF Maintenance is undertaken by the cooperative organization CORIMA

LOCAL ADMINISTRATION Parc Marin de Miramare, Station de Contrôle, 34014 Trieste, Italy.

VISITOR FACILITIES Access for tourism in the marine part is limited to passengers going to and from the port of Miramare. There is accommodation in the town of Miramare and nearby Trieste.

SCIENTIFIC RESEARCH AND FACILITIES A number of research activities, particularly in the field of oceanography, are being conducted, including plankton studies, sea-water chemistry and experimental fish breeding. These research projects are carried out by various research institutes located in Trieste. It is hoped that this area can provide baseline data for better control of marine pollution.

LOCAL POPULATION The coastal area is fairly densely populated, and there is a port at Miramare.

MODIFICATION OF THE NATURAL ENVIRONMENT The rest of the coast is the most polluted part of the Adriatic but currents protect the park from pollution

originating from the town of Trieste and its hinterland. It is also endangered by overfishing, both private and commercial. There is a risk of disturbance from recreational activities. Boats carrying passengers to the port of Miramare are allowed to cross the area.

PRINCIPAL REFERENCE MATERIAL

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Mount Hakusan

BIOGEOGRAPHICAL PROVINCE 2.02.02 (Japanese Evergreen Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED 12 November 1962 designated a National Park, under the National Parks Law 1957, and accepted as a Biosphere Reserve in 1980.

GEOGRAPHICAL LOCATION This area is located on the borders of the prefectures of Gifu, Ishikawa, Toyama and Fukui. 36°10'N; 136°50'E.

ALTITUDE 170-2,700m

AREA 48,000ha including the 18,000ha core area

LAND TENURE 67% of the area belongs to the government; 8% to local public entities, and 25% to private parties. The privately-owned land constitutes 14% of the core area and 31% of the buffer zone.

PHYSICAL FEATURES Most of the park is a highland area, bounded by several rivers, the Sho to the east, the Tedori to the west and the Ono basin and upper Kuzuryu to the south. The rocks are predominantly of Jurassic age and include volcanic rocks with hornblende andesite and pyroxene andesite with intrusions of quartz trachyte. There is ample evidence of volcanic activity, Mount Hakusan being the highest volcanic peak with eight waters near the summit. There are many craters, most of which now contain lakes including Senja-ga-ike, the only sub-arctic lake in Honshu. River erosion has also produced deep V-shaped valleys with waterfalls. The monthly minimum and maximum temperatures at Shiramine village on the outer border of the area are -3.3°C and 3.4°C in January and 18.1°C and 28.0°C in July. The annual precipitation is 3238mm, winter being the wettest season. This area is one with the most snow in Japan: at Shiramine, snow once fell up to a depth of 243cm; it is not rare to see a snowdrift 10m deep in the mountains.

VEGETATION There is a typical vertical zonation of vegetation, ranging from warm-temperate to alpine zones. There is still a vast forest of Fagus crenata in the cool-temperate zone. Along the Tedori River, Fagus crenata is mixed with Cryptomeria japonica which grows alone or in groups. Exploitation has never reached the subalpine zone of the area, where Abies mariesii, Tsuga diversifolia and Betula ermani grow. This area's alpine zone is the westernmost in Japan, and has abundant groups of Pinus pumila, and a diverse range of flowering plants. The whole area is full of snowslip lands because of the heavy snowfall and steep hills. These snowslip lands prevent the growth of trees but altherbosa, unique to the area, thrives.

FAUNA The area of natural forest is so large that almost all of Japan's mammals can be found here, including Asian black bear Selenarctus thibetanus, Japanese macaque Macaca fuscata and Japanese serow Capricornis crispus. The varied avifauna includes golden eagle Aquila chrysaetos, rare otherwise in Japan. Others, including Indian tree pipit Anthus hodgsoni, Japanese accentor Prunella collaris and Japanese hedge sparrow P. rubida are all alpine birds at the western limit of their ranges.

CULTURAL HERITAGE The countryside is inhospitable and was only settled by a few foresters who cut wood for charcoal making in the lower valleys. Included in the park is the Shurayamahime Shrine which was first constructed a thousand

years ago to the Goddess of the White Mountain. Mount Hakusan has long been regarded as one of the most noted and worshipped mountains in Japan.

ZONING/CONSERVATION MANAGEMENT There is a core area designated a Special Protection Area, surrounded by a Special Area and Ordinary Areas which together constitute a buffer zone. The area is zoned for management purposes, and two trails set up for walkers.

STAFF One official for protection

LOCAL ADMINISTRATION Ichinose Ranger Office, Hakusan National Park, Ichinose, Shiramine-mura, Ishikawa-gun, Ishikawa Prefecture, 920-25. November-April: Ichinose Ranger Office, Hakusan National Park, 8-34 Shiramine, Shiramine-mura, Ishikawa-gun, Ishikawa Prefecture, 920-25.

VISITOR FACILITIES There are about 30,000 visitors annually, mostly for walking and mountain-climbing. Six lodges have accommodation for 500 people and there is a visitor centre providing various services. The higher slopes are only open for about a month, in July and August.

SCIENTIFIC RESEARCH AND FACILITIES A group of scientists started an ecological study of Macaca fuscata in 1962. The Primate Research Institute of Kyoto University and the Japan Monkey Centre have continued this study. From 1966 to 1970, the study was conducted along with that of Capricornus crispus as a part of IBP. Since 1964 they have been studying the social structure of monkeys in this area. In 1974 Ishikawa prefecture set up the Hakusan Nature Conservation Centre to start a comprehensive scheme of protection and care of the natural environment. The Centre is also conducting a wide range of studies, mainly on large mammals like Macaca fuscata, but also of plants, weather and folklore. In winter the centre is cut off by snow and staff move to an office at the foot of the mountain, 14km away.

LOCAL POPULATION The area is mountainous and very cold in winter, and there are no permanent residents. There are temporary inhabitants associated with tourist development.

MODIFICATION OF THE NATURAL ENVIRONMENT There is no timber industry in the area, and the primeval forests are unexploited. There are four small inns open during the summer, but during the winter there are no permanent residents.

PRINCIPAL REFERENCE MATERIAL

Japan Nature Protection Association, Chubu Branch, Hakusan Research Group (1970). Hakusan no Shizen (Nature in Hakusan).

Mount Odaigahara and Mount Omine

BIOGEOGRAPHICAL PROVINCE 2.02.02 (Japanese Evergreen Forest)

LEGAL PROTECTION Total; the whole area is included in the Yoshino-Kumano National Park.

DATE ESTABLISHED The Yoshino-Kumano National Park, which includes this Biosphere Reserve, was established on 1 February 1936 under the National Parks Law 1931, now replaced by the Natural Parks Law 1957. Accepted as a Biosphere Reserve in 1980.

GEOGRAPHICAL LOCATION In the central part of Kii Peninsula and including the ridge of Omine mountains, Mount Odaigahara and Osugi Valley; 12km north-west of Owase City. 34°10'N, 136°00'E.

ALTITUDE 200-1,915m

AREA 36,000 ha, of which 1,000 ha is within the core area

LAND TENURE 20% government ownership; 20% public land; 60% private land

PHYSICAL FEATURES The area includes several mountain ridges and the peaks of Mount Odiagahara 1,695m and Mount Omine 1,719m. The rocks are mainly of Palaeozoic and Mesozoic age, and include any sedimentaries, rare in Japan. Rocks such as sandstone, shales, chert, green tuff and greywacke can be seen exposed in precipices, up to 800m high which are a result of considerable uplift and erosion. There are remains of an ancient uplifted peneplain covering 700ha at the summit of Mount Odiagahara. Many of the valleys are deep, with waterfalls up to 200m high, due to uplifts and rejuvenation of the rivers. The area has the highest rainfall in Japan. At Odaigahara annual precipitation amounts to 4700mm, maximum in August. In 1923 one day's rainfall was recorded as 1011mm. Monthly mean temperature is 5.1°C in January and 17.3°C in July.

VEGETATION In this area many forests still remain intact and all types of forest vegetation of Pacific coastal mountainous region are well preserved. There is clear vertical zonation of vegetation from warm-temperate zone to subalpine zone. Communities with Abies veitchii of mostly pure forest in the high portion of the subalpine zone and communities with Magnolia sieboldii are specific to this area. Sciadopitys verticillata and Rhododendron quinqufolium grow in rocky precipitous areas. Endemic Pseudotsuga japonica, Chamaecyparis obtusa, Cryptomeria japonica, Sciadopitys verticillata and Picea jezoensis hondoensis, which is almost at its southernmost limit, are noteworthy in the distribution of conifers characteristic to Japan.

FAUNA Most species of mammals found in Japan inhabit this still primitive area, and their population density is high. Especially noteworthy are large mammals such as Japanese serow Capricornis crispus, Sika deer Cervus nippon and Asian black bear Selenarctos thibetanus. The high population density of Japanese macaque Macaca fuscata is second only to Yakushima Island. More than 60 species of birds breed here. This area belongs to the cool-water area, and is the most southern habitat in Japan of Salvelinus pluvius. The distribution of insect species both of cold and warm regions is noteworthy.

CULTURAL HERITAGE The area has been little touched by man's influences in the past, because of difficulty of access and religious beliefs; Mount Omine is worshipped and still closed to women.

ZONING/CONSERVATION MANAGEMENT Part of the Special Area has been designated a core area. The rest of the Special Area and Ordinary Areas of the park constitute a buffer zone where timber production is permitted to different extents, depending on the condition of the area. The core are encloses 1,000ha and is completely owned by the government. The Biosphere Reserve is part of the Yoshino-Kumano National Park. It is zoned to protect certain areas completely.

STAFF Besides landowners, an official is assigned for protection

LOCAL ADMINISTRATION Mount Yoshinoyama Ranger Office, Yoshino-Kumano National Park, 2,673-1 Yoshinoyama, Yoshino-cho, Yoshino-gun, Nara Prefecture, 639-31. Present address: Yoshino-Kumano National Park Office, 6251 Shingu, Shingu City, Wakayama Prefecture, 647.

VISITOR FACILITIES About 100,000 people visit the area annually for recreational purposes. There are two lodges with accommodation for 500 people.

SCIENTIFIC RESEARCH AND FACILITIES JIBP-CT(P) Committee of Japan, which aimed to classify plant communities and establish a basic theory on their protection and which selected areas and supplementary areas for the investigation, designated Mount Odaigahara as a supplementary area and conducted interdisciplinary investigations as one of the IBP programmes. This high rainfall area is of intense meteorological interest and meteorological observations were started in 1898 when the observatory was established. The collection of scientific data is still in the rudimentary stage, and detailed investigation and maintenance of the areas primitive state is to be promoted. There is an automatic meteorological observatory on the summit of Mount Odaigahara.

LOCAL POPULATION The area has always been sparsely populated and the main residents now are connected with tourist development and forestry.

MODIFICATION OF THE NATURAL ENVIRONMENT This area remains primitive and largely intact from human influence because of difficulty of access and religious creeds. Recently felling has been increasing rapidly owing to road construction in the interior, the development of technology and the fact that most forests are in private ownership. In the Omine mountains there is considerable felling, except in the ridgeline portion which is under strict control, and it is considered that the ridgeline portion is indirectly affected by the change of environment. Several dams in the Osugi Valley have altered drainage with the creation of features such as man-made lakes. The vegetation in parts is being affected by large numbers of tourists using the road, but the mountainous region is largely unaffected.

PRINCIPAL REFERENCE MATERIAL

Japan National Park Association (1974). Report of the Scientific Investigation of Omine Area in Yoshino-Kumano National Park.

Shiga Highland

BIOGEOGRAPHICAL PROVINCE 2.15.05 (Oriental Deciduous Forest)

LEGAL PROTECTION Total. The whole area is included in the Joshinetsu-Kogen National Park

DATE ESTABLISHED The Joshinetsu-Kogen National Park, of which this Biosphere Reserve is a part, was established on 7 September 1949 under the National Parks Law 1931 which is now replaced by the Natural Parks Law 1957. The Biosphere Reserve was approved in 1980.

GEOGRAPHICAL LOCATION Shiga Highland is located in Japan's central mountain district, 20km north-east of Nagano City, 36°43'N, 138°30'E.

ALTITUDE 800-2,305m

AREA 13,000ha, including 1,000ha of the core area

LAND TENURE 70% government owned and public lands; 30% privately owned. The whole core area is privately owned.

PHYSICAL FEATURES This is a mountainous area formed mostly by volcanic activity. Mount Shirane 2,162m is an active volcano which erupted in 1927 and 1932 and still has craters emitting gas. Many of the rocks deposited after such eruptions are green tuffs and there are extensive lava flows which often form plateaus. The volcanic lake on Mount Shirane is the most acid lake in the world with a pH of 0.8. There are many hot springs in the area. The plateaus carry moorland including poorly-drained swamps. At Maruike (1,480m) the annual mean temperature is 5.3°C; the mean maximum temperature in August is 21.1°C. Annual precipitation averages 1900mm with a snowfall season from November to April. Snow is deepest in the middle of February, up to 2.5m deep.

VEGETATION A typical vertical zonation of vegetation is observed in the northern highland. At a height of 1,500m, the vegetation changes from lower deciduous broad-leaved forests represented by Fagus crenata to upper evergreen coniferous forests which consist of Tsuga diversifolia and Abies mariesii. Where deforestation has taken place, Betula ermani dominates the upper forests, and Quercus mongolica and Betula platyphylla dominate the lower forests. Among many ponds and swamps, there are some high moors where one can find unusual plants such as Andromeda polifolia, Inula ciliaris and Salix reinii. Plants in the Mount Shirane region are characteristic of volcanic activity. The crater, with its recent eruptions and strong wind, does not have any plants growing around it. The peripheral area is a grassland of Sasa albomarginata with some low trees like Sorbus commixta. Around the non-grassed area, by solfataras, there are desert plants such as Deschampsia flexuosa and Sasa kurilensis. A community of shrubs including Rhododendron degronianum grows further away from the crater.

FAUNA The diversity of fauna is noteworthy. Large animals such as Japanese macaque Macaca fuscata and Japanese serow Capricornis crispus live deep in the mountain forests, and 64 species of birds breed within the area. Shiga Highlands are practically the southernmost habitat of the amphibian Hynobius nigrescens. Such alpine insects as Colias palaeno, Scopura longa and Leucorrhinia dubia are also found here.

CULTURAL HERITAGE The lower slopes below 1,500m have long been deforested for fuel but the area has otherwise been little changed by man's activities.

ZONING/CONSERVATION MANAGEMENT The Special Area includes a core area of 1,000ha. Outside this in the rest of the Special Area and Ordinary Areas timber production is permitted to varying extents. The core area is protected completely from human influence. The skiing grounds are mown in summer. Some of the lower areas which were deforested have been replanted but some have regenerated naturally.

STAFF One official assigned to protection

LOCAL ADMINISTRATION Manza Ranger office, Joshin'etsu Kogen National Park, Manza, Tsumagoi-mura, Agatsuma-gun, Gunma Prefecture, 377-15. Shiga Kogen Ranger Officer, Joshin'etsu Kogen National Park, Shiga Kogen, Yamanouchi-machi, Shimotakai-gun, Nagano Prefecture, 381-04.

VISITOR FACILITIES Tourist development has been rapid since the 1960s, particularly ski resorts. There are 96 lodges which can accommodate 15,000 people and 28 ski-slopes with 33,000m in total of lifts. There are also hot spring spas, public gardens, visitor's centres and car parks and the area is much visited in summer as a cool hill resort.

SCIENTIFIC RESEARCH AND FACILITIES Scientists of Shinshu University have conducted zoological research in this area since 1954. By 1973 an investigation of the whole area, including the abiotic environment, had been conducted. The reserve was designated as an area for the specific research of subarctic forests by the PT (productivity of terrestrial communities) of IBP in 1967. The research facility of Shinshu University was established and approved as the attached research institute by the Ministry of Education, Science and Culture in 1966. It is well equipped with facilities for research, experiments, lectures and exhibitions and has accommodation for 40 researchers besides its staff. It is six hours by car from Tokyo and is accessible all year round.

LOCAL POPULATION There is a relatively large population in surrounding areas which have used the lower forests for fuel for a long time, and many people associated with tourist developments live in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Below the 1500m level, almost the whole buffer area is secondary forest after deforestation for fuel. Some portions are afforested; the rest has been free from human influence for some time and shows various stages in succession. Forests in this area possess enough regeneration potential. The greatest human impact is caused through the recreational use of an annual two million visitors. Development has been rapid since the 1960s, after the area was designated a national park in 1949. The development of skiing grounds has been especially rapid, and there are now 28 grounds with 33,000m of lifts in aggregate. Slopes in these grounds are always under human influence, such as skiing in winter and mowing in summer, so they support only a simple vegetation dominated by Sasa spp.. The core area is privately owned, but this may help its protection.

PRINCIPAL REFERENCE MATERIAL

Bulletin of the Institute of Biology in Shiga Heights Nos. 1-4, Shinshu University, 1962-65.

Bulletin of the Institute of Natural Education in Shiga Heights, Shinshu University Nos. 15-16, 1966-77.

Yakushima Island

BIOGEOGRAPHICAL PROVINCE 2.02.02 (Japanese Evergreen Forest)

LEGAL PROTECTION Total, as part of the Kirishima-Yaku National Park

DATE ESTABLISHED The reserve is part of the Kirishima-Yaku National Park, declared on 16 March 1934 under the National Parks Law 1931. Yakushima Island was added on 16 March 1964 under the Natural Parks Act 1957 and accepted as a Biosphere Reserve in 1980.

GEOGRAPHICAL LOCATION The reserve includes the central part of Yakushima Island, 130km to the south of Kagoshima City, and parts of the island's southern and western coastal lowlands; 30°20'N, 130°30'E.

ALTITUDE 0-1,935m

AREA 19,000ha, of which 7,000ha is the core area

LAND TENURE 96% government owned; 0.5% is public land; private land includes 3.5% of the core area and 5.7% of buffer zone.

PHYSICAL FEATURES Yakushima Island is extremely mountainous, being only about 25km in diameter but with peaks up to 1,935m (Mount Miyanoura, the highest in Kyushu). The rocks consist of a basement of clay slate overlain by Palaeozoic sandstone and quartzite with granite intrusions in the centre of the island. The island is a horst block. The area has one of the highest rainfalls in Japan, over 4000mm per annum, with up to 8000mm in the mountains. Temperature varies considerably with altitude, mean annual temperature on the coast being 19°C but 15°C in the mountains, 3km away. The high rainfall and oceanic situation cause high humidities.

VEGETATION There is well marked altitudinal zonation from warm temperate to subalpine vegetation. The cool temperate zone lacks Fagus crenata but is instead dominated by yaku cedars Cryptomeria japonica growing in mixed forest over about 12,000ha between 800m and 1,700m. Many of these trees are over 1000 years old and called yakusugi. These can be up to 30m tall and 5m in diameter. Some are even thought to be over 3000 years old. The forest between 1,000m and 1,400m has many epiphytes and mosses due to the high temperatures and humidity. Three hundred of the 700 species of pteridophyte found in Japan grow here.

FAUNA There are fairly numerous populations of Japanese macaque Macaca fuscata yakui and sika deer Cervus nippon yakushimae, which are endemic subspecies. The insect fauna is diverse, and this area is both the most northern habitat of tropical Diplacodes trivialis and Orthetrum glaucum and the most southern habitat of Somatochlora uchidai and Damaster blaptoides, indigenous to Japan. Endemics include Tibicen esakii and Chrysozephyrus ataxus yakashimaensis. The fish fauna includes both temperate and tropical varieties.

ZONING/CONSERVATION MANAGEMENT There is a core of 7,000ha comprising a Wilderness Area and Special Protection Area. The buffer zone surrounding this is composed of the Special Area and ordinary area of the National Park and timber extraction is allowed to varying extents, depending on the condition of the forest.

STAFF Besides landowners, an official is assigned to protection.

LOCAL ADMINISTRATION Yakushima Island Ranger Office, Kirishima-Yaku National Park, 2384-10 Anbo, Yakushima, Kumage-gun, Kagoshima Prefecture, 891-43.

VISITOR FACILITIES The island is accesible by air or by a four hour ferry trip from Kagushima. There are about 40,000 visitors a year, mainly for walking, mountain climbing and skiing, which can be followed half an hour later by batting on subtropical beaches.

SCIENTIFIC RESEARCH AND FACILITIES A study of the ecology of Macaca fuscata yakui has begun in 1975 by scientists at Kyoto University. The Yakusugi forest is unique and in a highly natural state and research has included detailed studies of the timber. In 1968-1969 this was carried out by the CT section of the Japanese IBP committee (Okutomi 1968 and 1969).

LOCAL POPULATION There are no permanent residents in the mountainous area but people live in the lowlands and there is a town, Miyanoura, in the north of the island.

MODIFICATION OF THE NATURAL ENVIRONMENT There is concern about the over-exploitation of Cryptomeria japonica. There is a dam in the eastern part of the island producing 23,000KW of electricity and another 46 800KW plant is under construction. Many tourists visit the reserve and may cause some disturbance. There are also plantations of trees covering 1,400ha on the island.

PRINCIPAL REFERENCE MATERIAL

Okutomi, K. (1968). Forest vegetation of the northwestern part of Yakushima Island: JIBP-CT Report for 1967.

Okutomi, K. (1969). Forest vegetation of the northwestern part of Yakushima Island: JIBP-CT Report for 1968.

Mount Kenya Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 3.21.12 (East African Highlands)

LEGAL PROTECTION The area above 3,100m has been declared a National Park and the area between 1,600 and 3,100m constitutes Mount Kenya Forest Reserve (142,071ha).

DATE ESTABLISHED The National Park was established in 1949 and accepted as a Biosphere Reserve in April 1978.

GEOGRAPHICAL LOCATION Mount Kenya straddles the equator about 193km north-east of Nairobi and about 480km from the Kenya coast. The Park boundary is defined by the 3,100m contour line with two salients, Naro Moru and the Sirimon down to approximately 2,600m and centred at 0°10'S, 37°20'E.

ALTITUDE 1,600-5,199m

AREA Biosphere Reserve 71,759ha. National Park 58,800ha. Contiguous to Mount Kenya Forest Reserve (142,071ha).

LAND TENURE Government

PHYSICAL FEATURES Several mountain peaks with isolated glaciers. The entire mountain is deeply dissected by valleys radiating from the peaks, which are largely attributed to glacial erosion. The base of the mountain is approximately 96km wide. There are about 20 glacial tarns (small lakes) of varying sizes and numerous glacial moraine features between 3,950m and 4,800m. The highest peaks are Batian 5,199m and Nelion 5,188m. The salients, comprise 3-5km wide ridges.

VEGETATION This varies with altitude and rainfall, and there is a rich alpine and sub-alpine flora. Juniperus procera and Podocarpus spp. are predominant in the drier parts of the lower zone (below 2,500m), with rainfall between 875 and 1400mm (Naro Moru and Sirimon tracks on the western slopes). In wetter areas (over 2200mm/year) in the south-west and north-east, Cassipourea malosana predominates. However, most of this lower altitude zone is not within the reserve and is now used for growing wheat. Higher altitudes (2,500-3,000m with rainfall over 2000mm/year) are dominated by a bamboo Arundinaria alpina on south-eastern slopes, and a mosaic of bamboo and Podocarpus milanjianus with bamboo at intermediate elevations (2,600-2,800m), and Podocarpus at higher and lower elevations (2,800-3,000m) and (2,500-2,600m). Towards the west and north of the mountain, bamboo becomes progressively smaller and less dominant. There are also areas in zones of maximum rainfall 2,000-3,500m with up to 2,400mm/year, where Hagenia abyssinica with H. revolutum predominate. Above 3,000m, cold (low temperatures) become a more important factor, tree stature declines, and Podocarpus is replaced by Hypericum spp.. A more open canopy here results in a more developed understorey. Grassy glades are common especially on ridges. The lower alpine or moorland zone (3,400-3,800m) is characterized by high rainfall, a thick humus layer, low topographic diversity, and low species richness. Tussock grasses Festuca pilgeri, and sedges Carex spp. predominate. Between the tussocks there are Alchemilla cyclophylla, A. johnstonii, and Geranium vagans. The upper alpine zone (3,800-4,500m) is more topographically diverse, and contains a more varied flora. Many of the species here are bizarre, especially the giant rosette plants Lobelia telekii and L. keniensis, Senecio keniodendron and Carduus spp.. Senecio brassica is found in both the lower and upper alpine zone. There are a variety of grasses

on well-drained ground and along the streams and river banks such as megaphytic Senecio battescombei and Helichrysum kilimanjari. Continuous vegetation stops at about 4,500m although isolated vascular plants have been found at over 5,000m. There are 13 species endemic to Mount Kenya listed in Hedberg, (1951).

FAUNA In the lower forest and bamboo zone mammals include giant forest hog Hylochoerus meinertzhageni, tree hyrax Dendrohyrax arboreus, white-tailed mongoose Ichneumia albicauda, elephant Loxodonta africana (T), black rhinoceros Diceros bicornis (T)(seldom seen), suni Neotragus moschatus, black-fronted duiker Cephalophus nigrifrons and leopard Panthera pardus (T)(which has also been seen in the alpine zone). Forest birds include green ibis Mesembrinibis cayennensis (local Mount Kenya race), Ayre's hawk eagle Hieraaetus dubius, threatened Abyssinian long-eared owl Asio abyssinicus, scaly francolin Francolinus squamatus, Ruppell's robin-chat Cossypha semirufa, and numerous sunbirds (Nectariniidae). Moorland mammals include: localised Mount Kenya mouse shrew Myosorex polulus, hyrax Procavia johnstoni mackinderi, and common duiker Sylvicapra grimmia altivallis. Birds include: scarlet-tufted malachite sunbird Nectarinia johnstoni, montane francolin Francolinus psilolaemus, Mackinder's eagle owl Bubo capensis mackinderi, and the locally threatened scarce swift Schoutedenapus myioptilus. The endemic mole-rat Tachyoryctes splendens is common throughout the northern slopes and the Hinde Valley at elevations up to 4,000m. There have also been reported sightings of the golden cat Felis aurata.

ZONING/CONSERVATION MANAGEMENT The central National Park is surrounded by a buffer forest reserve. Continued protection is vital for Mount Kenya as it is a significant water catchment area. Initial attempts have been made to redesign the trail system, but with limited success. There are several draft management plans at various stages of implementation.

STAFF Three wardens and approximately 100 others (1984)

LOCAL ADMINISTRATION Warden, PO Box 69, Naro Moru.

VISITOR FACILITIES Mountain safaris are organized by the Naro Moru Lodge and a private safari company, and locally by the Mountain Club of Kenya. The Mountain Lodge is within the Forest. Access to the park is possible by the Sirimon track, the Naro Moru track (officially) and the Chogoria track, which has a control gate. There were 10,637 visitors in 1979.

SCIENTIFIC RESEARCH AND FACILITIES The Mount Kenya ecosystem is an excellent area for studying tropical alpine ecology. Studies of meteorology and palynology have been undertaken, but no rainfall data is available. Most work has been done above 3,800m and more comparative work is needed. An environmental monitoring station is to be established on Mount Kenya by UNEP and the Government of Kenya. There is one building with basic facilities, which was originally designated as a research facility.

MODIFICATION OF THE NATURAL ENVIRONMENT Human interference is low and mainly confined to the gazetted forest area at lower altitudes. Fire is a threat from humans and lightning is a threat in the dry, lower forest but recovery takes place through natural recolonization. Trail proliferation along the Naro Moru Track has resulted in muddy swathes up to 100m wide in the lower alpine zone, and the destruction of an estimated 10% of the entire valley-bottom habitat in the upper 3km of the Teleki Valley. There is concern that current construction of a high altitude road across the eastern slopes will cause large-scale degradation.

PRINCIPAL REFERENCE MATERIAL
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Woodley, B. (1959-1975). Quarterly Reports of Mount Kenya National Park. Unpublished.
Young, T. (1984). Status and Potential of Kenya's High Mountain Ecosystems. In: Endangered Resources for Development. Proceedings of a workshop on the status and options for management of plant communities in Kenya. National Museums of Kenya.
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Mount Kulal Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 3.14.07/3.26.14 (Somalian/Lake Rudolf)

LEGAL PROTECTION None

DATE ESTABLISHED April 1978 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Situated to the southeast of Lake Turkana (Rudolf) in the district of Marsabit. The western boundary is the centre of the lake and the eastern boundary is defined by the Chalbi Salt Desert. Access from Nairobi is by the main Nairobi-Moyale road or from Maralal to Loiengalani through Baragoi and South Harr. The reserve is 18 hours by road from Nairobi and two hours by air. 2°25'-3°25'N, 36°30'-37°30'E.

ALTITUDE 378-2,416m

AREA 700,000ha; includes South Island National Park (3,880ha)

LAND TENURE Marsabit County Council

PHYSICAL FEATURES The reserve is rectangular in shape and includes the saline-alkaline waters of Lake Turkana, the volcanic South Island and hot springs on the lakeshore. There are seasonal watercourses, but no perennial streams. The landscape is volcanic, formed during the Tertiary and Quaternary periods, comprising an extensive lava desert and numerous craters and lava flows. The reserve includes Teleki's volcano (active in 1899), and Mount Kulal (2,295m), a volcanic mountain with a deep crater capped by a mist/rainforest with deep box canyons on the eastern slopes. There is also a semi-desert of sand dunes and the Chalbi Salt Desert, an ancient lakebed which is occasionally flooded. Annual rainfall is 250-850mm and temperature range 20-40°C.

VEGETATION The vegetation ranges from mountain forest to desert and includes a montane zone (above 2,000m) with rainforest, mistforest and grassland; a

sub-montane zone (1,800-2,000m) with dry evergreen forest of Olea africana and Juniperus procera and shrub layer of Euclea spp. and Carissa spp., and grassland; a sub-humid/semi-arid zone (1,600-1,800m) of Combretum spp. woodland with Euphorbia spp. and Acacia drepanolobium woodland and an understorey of Duosperma eremophilum; a semi-arid zone (900-1,600m) of Acacia mellifera and Commiphora spp. bushland with an understory of succulent Euphorbia spp. and Plectranthusus spp.; and a semi-arid/arid zone (400-900m) with bushland of Acacia reficiens on sandy soils and woodland of Acacia tortilis with an understorey of Duosperma spp. and/or Indigofera spinosa on drainage lines. Evergreen shrubland of saltbush grows on saline alluvial soils bordering Chalbi. The lava desert supports sparse sub-shrubs and succulents. There are also desert communities induced by man and livestock, and salt desert.

FAUNA The montane zone has one small antelope and a sub-species of bird endemic to Mount Kulal, the montane white-eye Zosterops poliogaster kulalensis. The lower zones have a population of greater kudu Tragelaphus strepsiceros. The semi-arid and arid zones have fauna representative of the semi-arid areas of northern Kenya and Ethiopia including: Beisa oryx Oryx gazella beisa, gerenuk Litocranius walleri, reticulated giraffe Giraffa camelopardalis reticulata, Grevy's zebra Equus grevyi (T), dik-dik Madoqua guentheri, Grant's gazelle Gazella granti, rhinoceros Diceros bicornis (T), elephant Loxodonta africana (T), cheetah Acinonyx jubatus (T), lion Panthera leo, leopard P. pardus (T), and ostrich Struthio camelus. The population of Nile crocodile Crocodylus niloticus (T) in Lake Turkana is still relatively intact and fish communities adapted to brackish conditions include the Nile perch.

CULTURAL HERITAGE Long but probably discontinuous history of human occupation. There is archaeological evidence of pastoral and fishing populations near the old Chalbi Lake. Pastoralism continues but emphasis has apparently shifted during the past 300 years from cattle to sheep, goats and camels.

ZONING/CONSERVATION MANAGEMENT The core area occupies about 1,100ha near the centre of the reserve. The NEP-MAB Integrated Project in Arid Lands (IPAL) has produced comprehensive management guidelines for the use of the area's resources (including water, grazing, woodlands, water catchments, wildlife, soils, fish, livestock and human) and made recommendations on an infrastructure of roads, settlement centres, markets, education, and health services. The central consideration of the plans is the human element. The District Development Committee (DDC) has agreed to form a sub-committee to oversee implementation of the management plans.

STAFF One forester, three forest rangers and 20 police officers for administration and maintenance; two drivers, one foreman and one warden for research and monitoring: and one senior ecologist in charge of research, five field scientists and 10 field and laboratory technical assistants.

LOCAL ADMINISTRATION Director, National Environment Secretariat, Office of the President, PO Box 30510, Nairobi. Or: Unesco/IPAL, PO Box 30592, Nairobi.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES IPAL are concerned with the causes of desert encroachment. The main objective is to produce recommendations on land-use strategies and alternative economies which will permit rehabilitation of degraded lands and provide a living for the expanding human populations of

the region. The first priority is to conserve existing resources and prevent further ecological and sociological degradation. It is anticipated that the present research programme will create the framework for an institution to monitor the Mount Kulal area as an example of the arid zone of East Africa. Such an institution is expected to be significant as a centre for survey, monitoring, and arid zone research, and as a training and orientation centre. Facilities include a small research station on the southern slopes of Mount Kulal with laboratory and housing for 6 scientists and ancillary staff, smaller field stations in the working area and fenced experimental plots for the study of succession, protection from animal and human exploitation, grazing trials, productivity, plantation, and the demonstration of the results of management. The access road is rough and only suitable for cross-country four-wheel drive vehicles. The IPAL research station on Mount Kulal has an airstrip and there are more at several other field stations in the area.

LOCAL POPULATION There are about 1,000 Samburus on Mount Kulal, 1,000 Turkana around Loiyangalani, and 300 El Molo on Lake Turkana.

MODIFICATION OF THE NATURAL ENVIRONMENT Alteration of grazing practices due to restriction of movement of nomadic peoples has resulted in overgrazing with replacement of perennial grasslands by annual and ephemeral vegetation and locally by desert. Due to the long history of human settlement, it is not possible to ascertain the original or 'natural' vegetation. The major and increasing human impact is tree felling for fuel and construction of houses and enclosures for livestock. The montane and sub-montane forests on Mount Kulal have been reduced and forest regeneration is hindered in several areas by removal of the understorey. Grass fires started by pastoralists erode the forest edge. Other problems are periodic droughts and the concentration of people and livestock into settlements.

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Malindi-Watamu Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 3.14.07 (Somalian)

LEGAL PROTECTION Two Marine National Reserves and two Marine National Parks gazetted under the Wildlife Conservation and Management Act 1976. Protected under Legal Notices 98 and 99.

DATE ESTABLISHED 1968; accepted as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION A strip of coast and sea 30km long and 5km broad and including Mida Creek; south of Malindi and 88km north of Mombasa. 3°14'-3°25'S, 39°57'-40°11'E.

ALTITUDE Sea level

AREA Marine national reserves 21,309ha and marine national parks 1,600ha; Biosphere Reserve 19,600ha

LAND TENURE Government

PHYSICAL FEATURES Three major habitats can be identified: intertidal rock; intertidal sand and mud; and the sublittoral area. Notable features include 'rock platforms' and cliffs. In the Watamu area there are caves and coral reefs inhabited by fish. There is no continental shelf and the coastline is bordered by fringing reefs on the seaward side with water depth dropping sharply within short distances. Between the limestone cliffs are stretches of beautiful sandy beach. Mida Creek contains tidal mudflats with fringing mangrove swamp. Whale Island is located at the creek entrance. The southern monsoons between April and October create a current up to 4 knots with northern monsoons between November and March. Temperature variation of 34°C maximum and minimum 2°C with mean annual temperature of 26°C. Monthly rainfall varies between 2mm and 390mm.

VEGETATION The varied marine flora includes algae Padina commersonii, Dictyota bartayresiana and Udotea indica. Microscopic marine plants occur throughout the sublittoral zone but only occasionally on mobile sand or actively growing coral. They are absent from the upper part of the intertidal zone (except the brown alga Bostrychia binderi) and in the extensive mangrove areas of Mida Creek in Watamu. In the intertidal sand and mud the finer sediments below water, which are subject to less wave action, have become fixed by growth of marine angiosperms including Cymodocea rotundata, C. ciliata, Halodule wrightii, Thalassia hemprichii and Syringodium spp.. The mangroves Rhizophora mucronata, Bruguiera gymnorrhiza, and Ceriops spp. merge with terrestrial vegetation. Considerable quantities of drifted plant debris, mainly dead leaves shed by C. ciliata, accumulate on the sloping sandy beaches. Palms and casuarina trees indicate the high water mark.

FAUNA Whale Island is a nesting ground for roseate tern Sterna dougallii and bridled tern S. anaethetus between June and October. Shore birds include:

sanderling Calidris alba, curlew sandpiper C. ferruginea, whimbrel Numenius phaeopus, grey plover Pluvialis squatarola, greater sand plover Charadrius leschenaultii, and Mongolian plover C. mongolus. Non-breeding visitors include: lesser crested tern Thalasseus bengalensis, Saunder's little tern Sterna saundersii and sooty gull Larus hemprichii. The intertidal rocks are inhabited by rock crabs Grapsis maculatus and Geograpsis lividus, small rock gobies, anemones, a few Holothuria, and the large flat six-plated barnacle. There are numerous small caves with dripping water which support a dense population of the ghost crab Ocypode kuhlii. Near the foot of the cliffs a red and white xanthid crab is common, and below this the porcelain crab Petrolisthes predominates. Sandy beaches are characterized by talitrid amphipods (four species including Ocypode ceratopthalma), an ippid crab, gastropod molluscs, and some polychaetes and also the hermit crab Coenobita rugosus and occasional Ocypode kuhlii occur. Species comprising the heads of the coral gardens are primarily Porites supplemented by the branching Acropora, Pocillopora, colonies of Cyphastrea, Galaxea, brain corals and Millepora. Other species include Ophicoma crinaceus in coral cracks, Echinometra mathaei and Diadema on the surface and Diadema, Echinothrix and the large blue fish Linkia laevigata beneath overhangs. Molluscs include Tridacna squamosa attached to the coral, Barbatia spp. inside the coral, Lithophaga spp. which burrows extensively through it, tiger cowrie Cypraea tigris, large oyster Pinctada margaritifera (I) and numerous species of nudibranchs. Marine worms (Polychaeta) include the sabellid fan worm and serpulids, which are common in the coral.

ZONING/CONSERVATION MANAGEMENT The Biosphere Reserve comprises the Malindi-Watamu Marine National Parks and Malindi-Watamu Marine National Reserves. The national parks constitute the core areas, and the national reserves form the buffer zone. The management plan identifies three zones: park service zone (land), recreation zone (concentration of water-based recreation) and natural environment zone (coral reef in Malindi Marine National Park and the area of mangrove community of Watamu Marine National Reserve). A management plan for the whole area was prepared by the Wildlife Conservation and Management Department in 1982, but the plan has not been officially accepted. It has been suggested that the adjacent section of Arabuko Sokoke Forest, which contains two nature reserves, should be included in reserve.

STAFF Two wardens, 26 rangers and 17 support staff (1980)

LOCAL ADMINISTRATION Warden, Marine National Parks, PO Box 109, Malindi.

VISITOR FACILITIES There are 50,000 visitors annually, of which half are Kenyans. The major attractions are boat trips, water sports, and coral viewing. Access is mainly through private land belonging to hotels therefore, visitor control and revenue collection is difficult.

SCIENTIFIC RESEARCH AND FACILITIES Some research has been carried out on corals, turtles, ecological zonation and siltation effects on reef ecology. High potential for research. A government-appointed officer is investigating the possibility of establishing a marine research station. The Marine Park Education Centre was opened in 1968.

MODIFICATION OF THE NATURAL ENVIRONMENT The most significant human effect on the area at present is the silting of the Sabaki River which carries a heavy load of silt during rainy seasons as a result of uncontrolled cultivation in the Ukambani hills. Corals and shells have been exploited heavily by visitors and local tradesmen for souvenirs. This was prohibited by the gazettment of

the protected areas and there has been considerable recovery, but some poaching persists. There is apparent tourist pressure during the peak tourist season. The effects on the ecosystem of permitted activities such as swimming, sailing and snorkelling have not yet been investigated, but there are possible disturbances due to trampling and boat anchorage. Some fishing occured prior to the establishment of the reserve, but this is now prohibited apart from some traditional fishing. It has been noted that the fish populations are smaller in the reserves where fishing is still allowed and when proper monitoring has been carried out it may be necessary to introduce quota fishing systems and controls on fishing methods used. There is no pollution from the city of Malindi as the sewage system is closed but there have been oil spills from tankers in the deep seas. The extent of oil pollution has not yet been investigated.

PRINCIPAL REFERENCE MATERIAL

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Kiunga Marine National Reserve

BIOGEOGRAPHICAL PROVINCE 3.14.07 (Somalian)

LEGAL PROTECTION Partial, under the Wildlife Conservation and Management Act 1976. The boundaries are delineated on Boundary Plan No. 216/39, which is deposited in the Survey Records Office, Nairobi.

DATE ESTABLISHED 1979 by Legal Notice No. 291 in the official Kenya Gazette. Accepted as a Biosphere Reserve in 1980.

GEOGRAPHICAL LOCATION North-eastern coastal border of mainland Kenya and the Pate Islands, Indian Ocean. 1°75'-2°00'S, 41°20'-41°25'E.

ALTITUDE 0-30m

AREA 25,000ha; Biosphere Reserve 60,000ha including the marine area contiguous to Dodori National Reserve (87,739ha), which is itself almost contiguous to Boni National Reserve (124,000ha)

LAND TENURE The offshore islands and mangrove swamps are state owned and administered by Lamu County Council. The coastal waters are under the supervision of the Fisheries Department and the Wildlife Conservation and Management Department (Ministry of Environment and Natural Resources).

PHYSICAL FEATURES The coast has sandy beaches, some with mangrove swamps, with about 50 calcareous offshore islands and coral reefs paralleling the coastline. The upper part of the reserve on the mainland consists of sand dunes and there is dry coastal shrubby forest.

VEGETATION Great variation of marine flora. In the sublittoral zone microscopic marine plants are absent only from areas of mobile sand and actively growing coral though sometimes gaining foothold in these unfavourable habitats. Microscopic marine plants are absent from the upper part of the intertidal zone except for areas of Bostrychia bindelia. In the intertidal sand and mud, the finer sediments below water, which are subject to less wave action, have become fixed by growth of marine angiosperms and there are extensive areas of dugong grass (green algae) and Zostera spp.. Dwarf shrub thickets of salt-tolerant plants (halophytes) typical of the Indo-Pacific beach littoral zone are common on the mainland, and species include Ipomoea pes-caprae, Cyperus maritimus, Suaeda, and Tephrosia. Mangrove swamps dominated by Rhizophora mucronata occur in the sheltered tidal waters between Mwanzi and Mkokoni.

FAUNA The offshore islands are rich in seabirds and there are large nesting colonies of various gulls and terns (particularly numerous in the breeding season from June to August) including: sooty gull Larus hemprichii, roseate tern Sterna dougallii, white-cheeked tern Sterna repressa, and bridled tern S. anaethetus. Dugong Dugong dugon (V) and green turtle Chelonia mydas (E) are also common. Several large land mammals frequently visit the mainland buffer area including Hunter's antelope Damaliscus hunteri (T) and elephant Loxodonta africana (V). Lesser kudu Tragelaphus imberbis are resident on some of the islands. Extensive coral and reef fish populations occur.

ZONING/CONSERVATION MANAGEMENT Dodori National Reserve, which occupies the mainland area inland of the Kiunga Reserve, is the main buffer zone separating the increasing human activities on the mainland from the coastal beach areas.

STAFF Currently supervised by the Game Warden from Lamu; staff of 45 proposed

LOCAL ADMINISTRATION Warden, WCMD, PO Kiunga, via Lamu.

SCIENTIFIC RESEARCH AND FACILITIES The Kenyan government has completed the construction of a marine research station at Kiunga consisting of laboratories, junior staff houses and three houses for scientists. The station is equipped, but there are no marine research scientists locally available. There is a need for basic research and the training of local marine scientists, which will, in the initial phases, require cooperation and support from international research and financing institutions - Unesco assistance through the MAB programme has been suggested.

MODIFICATION OF THE NATURAL ENVIRONMENT There has been little human interference in the area and this constitutes one of the main reasons for protection. There has been limited collection of reef coral and shells for selling purposes. The rate of cutting of the mangrove forest for commercial purposes was on the increase before Reserve status was declared, but is now under control. Poaching of green turtle and its eggs is now under the control of the Game Warden from Lamu. There is some poaching of dugong. Certain

water sports are allowed within the park including water skiing and the passage and anchorage of boats, and use of the beaches is under the control of the authorities. Kiungu is, however, the least developed of the Kenyan Marine Parks/Reserves.

PRINCIPAL REFERENCE MATERIAL

No information

Mount Sorak Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.15.05 (Oriental Deciduous Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED The Nature Reserve was designated on 5 November 1965, and the National Park on 24 March 1970 under the National Monument Protection Law (No. 2233) of 10 August 1910, the Law of Forestry (Act 67,68 of 1908), and National Park Law of 1962. Accepted as a Biosphere Reserve in June 1982.

GEOGRAPHICAL LOCATION Near the east coast of the Korean Peninsula in Ganweondo province, about 200km from Seoul. 28°09'N, 128°24'E.

ALTITUDE 350-1,708m

AREA National Park: 35,460ha. Biosphere Reserve: 37,430ha.

LAND TENURE Biosphere Reserve: 21,270ha government owned; 16,160ha privately owned. Nature Reserve: 12,258ha government owned; 4,101ha privately owned.

PHYSICAL FEATURES The park is situated in the northern park of the Taebaek Range, a complicated mountain range of strongly dissected granite and gneiss with spectacular rocky hills and ridges. Mount Sorak is the third highest mountain in the country, with the main peak (Daechung) at 1,708m. The mountain commands views of the surrounding deep gorges and ridges, rugged peaks, fantastically shaped rocks, waterfalls and pools. Two small rivers flow into the Han River. The climate is continental with mean annual precipitation 1053mm, falling mostly during the summer months. Mean annual temperature at 200m is 9.9°C.

VEGETATION This is the only mountain belt in Korea where alpine plants occur naturally. At lower altitudes the vegetation is principally mixed deciduous broadleaved forest with stands of red pine Pinus densiflora. Principal species are sawtooth oak Quercus serrata and Fraxinus rhynchophylla. At higher altitudes the forest becomes mixed coniferous and broadleaved deciduous containing Betula davurica and Corylus mandshurica. Communities with arctic species such as Arctous rubra and Anemone narcissiflora are found at high altitudes. The flora belongs to the Sino-Japanese region, temperate subregion, Korean district. There are 929 vascular plant species (including 181 varieties). Endemic plants include Spiraea pubescens var. lasiocarpa, Tilia mandshurica var. villicarpa, Veratrum mackii var. macranthum, Clematis koreana and Angelica xegaphylla.

FAUNA The park has a varied fauna including 26 species of mammal, 92 of birds, 11 reptile and 42 amphibian species, and 351 species of insect. The mammals include lesser panda Ailurus fulgens, musk deer Moschus moschiferus, Asian black bear Selenarctos thibetanus, sable Martes zibellina and common goral nemorhaedus goral. A number of animals in the park are endangered or restricted distributions, including Tristam's woodpecker Dryocopus javensis (E), only found in a few small areas in the immediate vicinity, black woodpecker D. martius, and muldukkobi Bufo steginegeri.

CULTURAL HERITAGE This area has many legends associated with it and there are a number of temples and hermitages which have always attracted visitors and pilgrims.

ZONING/CONSERVATION MANAGEMENT The strict nature reserve is given special protection and although the other areas suffer some interference they may act as a buffer zone. Special protection is given to some species, including reheaded woodpeckers and lesser pandas, which are being studied. A development plan covering roads hotels and tourism was drawn up but a management plan is lacking.

STAFF A total of 75 staff, including seven administration staff and 24 rangers, assistants and temporary employees.

LOCAL ADMINISTRATION Office of Mt. Sorak National Park. Sorak-dong, Sokcho Si, 210-20 Kangwan-do, Republic of Korea.

VISITOR FACILITITES Tourism is developing fast with a cable car to Kweon-Kum-Sung, a settlement round the spring at Nam Seolag and a network of trails. The park has many visitors, and a variety of accommodation is available.

SCIENTIFIC RESEARCH AND FACILITIES An extensive field survey was carried out in 1966, including physiography, vascular plant species, plant communities, vertebrates and insects. There is no monitoring at present except of visitor numbers. There are a few facilities at present and poor access from the nearest colleges of Chuncheon and Kangnung.

LOCAL POPULATION There are several small mountain villages in the area and the region has winter sports developments.

MODIFICATION OF THE NATURAL ENVIRONMENT Much of the area outside the strict nature reserve has been modified by lumbering, burning, grazing and slash and burn agriculture, but is now developing into good secondary forest. Two main roads pass through the park. Round the margins there is still wide agriculture and herb collecting for traditional use. There is some serious erosion of natural vegetation near the upper cable station.

PRINCIPAL REFERENCE MATERIAL

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Parc national de la Boucle du Baoulé and associated reserves

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Protection is not complete within the reserves, where some traditional practices are still allowed.

DATE ESTABLISHED Boucle du Baoulé was protected as a Reserve in 1950 and established as a National Park in 1953. The Badinko Reserve was established in 1951-1952, Fina Reserve in 1954, and Koungossambougou Reserve in 1955. The park, and all three reserves, were accepted as a Biosphere Reserve in June 1982.

GEOGRAPHICAL LOCATION On the Baoulé River approximately 200km north-west of Bamako in western Mali. 13°45'-14°23'N, 8°23'-9°25'W.

ALTITUDE 300m

AREA Boucle du Baoulé Biosphere Reserve (771,000ha); Boucle du Baoulé National Park (350,000ha); Fina Faunal Reserve (136,000ha); Badinko Faunal Reserve (193,000ha), and Koungossambougou Faunal Reserve (92,000ha).

LAND TENURE Government

PHYSICAL FEATURES The main part of the area is made up of the hard, horizontally bedded Ordovician sandstone of the Madingue Plateau. This rock has been weathered and eroded to form inselbergs with almost vertical sides, rising 200m above the surrounding area, steep rubble slopes, piedmonts covered with sediment, and canyons whose walls overlook the alluvial river beds below. There are also mudstones of marine origin, schists, permeable sandstones and dolomite. The area also contains a broad alluvial belt which is a relic of the geological period when the upper Niger drained through the Baoulé into the Senegal River. The mean annual temperature is 29.7°C and the mean annual precipitation 950mm, falling between June and October.

VEGETATION The reserves contain three biogeographical zones: 1) the sudano-guinean zone to the south, characterised by a tree layer particularly of Combretaceae and Acacia spp. and a grass layer made up mainly of annual grass species; 2) the Sahelian zone to the north characterised by spiny vegetation adapted to xeric conditions and a sparse grass cover; 3) and the riverine forest bordering the Baoulé River, which is very dense and contains many creeping plants and bamboo. The park also contains examples of Butyrospermum paradoxum savanna, an artificial vegetation type which results from cultivation of Isoberlinia woodland.

FAUNA There is a large diversity of species although individual populations are rather small as a result of repeated bushfires and poaching in the past. Large mammals include: roan antelope Hippotragus equinus, Defassa waterbuck Kobus ellipsiprymnus, giant eland Taurotragus derbianus (with Niokolo-Koba in Senegal, are of the last two populations in West Africa) eland T. oryx (in the Fina reserve), hartebeest Alcelaphus buselaphus, oribi Ourebia ourebi, warthog Phacochoerus aethiopicus, giraffe Giraffa camelopardalis, elephant Loxodonta africana (T), hippopotamus Hippopotamus amphibius, lion Panthera leo, leopard P. pardus (T), cheetah Acinonyx jubatus (T), olive baboon Papio anubis, vervet monkey Cercopithecus aethiops and patas monkey Erythrocebus patas. There is

also an abundant avifauna, including many migratory species. A list of mammal and bird species can be found in Sayer (1975).

ZONING/CONSERVATION MANAGEMENT The core area is made up of the Boucle du Baoulé National park where theoretically all human intervention is excluded. The reserves adjacent to the park, Fina, Badinko, and Koungossambougou, make up the buffer zone, where certain traditional land use practices such as hunting are permitted. Attempts are being made to relocate the settlers that currently live within the park. However, application of the laws has been concentrated on areas used for tourism, so in the past Boucle de Baoulé has received little attention while Fina has been treated as a National Park. Under the bilateral project on agronomic research between the Netherlands and Mali, attempts are being made to regulate and rationalise land use. Geerling (1983) makes a number of management proposals, suggesting different management objectives for the different sectors of the whole area. Earlier, FAO/UNDP were involved in development of the area and Sayer (1975) makes a number of recommendations.

STAFF A total of 49 persons work in the park and adjacent reserves, mainly for protection activities. There are also visiting scientists under the RURGS Project (Recherche pour l'Utilisation Rationnelle du Givier en Sahel).

LOCAL ADMINISTRATION Opération Parc National de la Boucle du Baoulé, Testard, Bamako, BP 275 (which also manages the adjacent reserves).

VISITOR FACILITIES There is limited accommodation at Baoulé and Madina and guides are available.

SCIENTIFIC RESEARCH AND FACILITIES A comprehensive study on the Boucle du Baoulé National Park was undertakn by FAO from 1972 to 1974. The Netherlands/Mali project on Recherche sur l'Utilisation Rationnelle du Gibier du Sahel (RURGS), which began in 1977, is continuing integrated studies to improve utilisation of the natural resources by local populations and also to enable the remaining wildlife to build up population numbers. This reserve has been selected as a pilot biosphere reserve in arid/semi-arid lands. Research is also carried out by students from the Institute Polytechnique of Katibougou.

MODIFICATION OF THE NATURAL ENVIRONMENT The whole area has suffered from a long history of human impact mainly by overgrazing, fire, and hunting. These impacts are shown by the decrease in annual grass species and a corresponding increase in perennial species, increase in pyrophytes and spread of laterisation in the sudano-guinean zone, decrease in vegetation cover and encroaching desertification in the soudanian and sahelian zones. Because areas surrounding the park were managed for hunting until recently, the situation arose where game was more readily visible outside the park - probably because of reduced poaching where there were licensed hunters and guards. Grazing of domestic animals within the park is also a problem, particularly during time of drought.

PRINCIPAL REFERENCE MATERIAL

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Macchabée-Bel Ombre Nature Reserve

BIOGEOGRAPHICAL PROVINCE 3.25.13 (Mascarene Islands)

LEGAL PROTECTION Total

DATE ESTABLISHED Various nature reserves were established in 1951 and united in 1974 by the addition of the Black River Gorges area (Les Mares and Plaine Champagne), which joined Macchabée, Petrin, and Bel Ombre reserves. It was accepted as a biosphere reserve in October 1977.

GEOGRAPHICAL LOCATION Composed of Petrin, Ste. Marie and Cocotte, Bel Ombre, Macchabée and Mare Longue, Petites Gorges, Florin, Desgranges, Les Mares, Mesliers, Plaine Champagne and Black River Gorges. Centred at 20°25'S, 57°26'E.

ALTITUDE 50-650m

AREA 3,611ha (Biosphere Reserve listed as 3,594ha)

LAND TENURE Government

PHYSICAL FEATURES The area comprises a plateau in the north, the deep Black River Gorges in the middle sector, and, towards the south, a gentle southerly slope below a steep scarp. The soil is variable; at Petrin and Plaine Champagne it is either ground water laterite with lateritic concretion, or low humic gleys. At Macchabée/Mare Longue, the soils are humic ferrogineous latosols, and at Bel Ombre, a brown forest soil predominates.

VEGETATION At Petrin, the various series in vegetation succession leading to climax forest are evident. The marshy spots are characterised by Lycopodium spp., Pandanus spp., Sphagnum spp. and sedges such as Cyperus; the dry areas are characterised by Philippia/Phylica heath. Some of the plants found in this dry area are Astelia hemichrysa (rare), Coffea spp., Blechnum attenuatum, and Trochetia spp.. In the Macchabée/Mare Longue area, there is upland evergreen climax forest dominated by Myrtaceae, Rubiaceae and Sapotaceae, of which about 20-25% are endemic. Most orchid species such as Phaius spp. and Jumellea fragrans are threatened. Tree species of concern due to their lack of regeneration and endemic status are Sideroxylon grandiflorum, Ocotea cupularis, Tambourissa sieberi, and Canarium paniculatum. In Petites Gorges, Florin, Desgranges, Les Mares, Mesliers and Black River Gorges, about 900ha are covered with evergreen forest, extensively invaded by exotics. The remainder is composed partly of low native scrub, marshy vegetation, and heath vegetation. These are mixed with the exotic, aggressive Psidium cattleianum, and Rubus alcaefolius. There are various rare endemic plants, including some Pandanus spp., and Trochetia spp.. At Ste. Marie and Cocotte, mossy forest has been badly degraded as a result of successive cyclones. It has many species of orchids, ferns and mosses. In Bel Ombre, mid-altitude forest composed mainly of Labourdonnaisia glauca, Mimusops petiolaris and various Diospyros spp. predominates. A single tree of Olax psittacorum, previously known only from old collections, was found in Black River Gorges in the 1960s, and Gaertnera longifolia, only collected once, was also recently found in the area (IUCN/WWF Project 3149). Also occuring in the Black River Gorges is a small stand of the beautiful Hibiscus columnaris. This species, endemic to Mauritius and Réunion, is only known from a few scattered individuals.

FAUNA The flying fox Pteropus niger, endemic to Mauritius, occurs here. All the rare endemic birds of Mauritius are found in this reserve - Mauritius kestrel Falco punctatus (E)(on of the rarest birds in the world), the pink pigeon Nesoenas mayeri (E), Mauritius fody Foudia rubra (E), Mauritius cuckoo-shrike Coracina typica (V), Mauritius parakeet Psittacula echo (E), Mauritius olive white-eye Zosterops chloronothos (V), and Mauritius black bulbul Hypsipetes olivaceus. The butterfly, Papilio manlius (I), is said to be quite common in Mauritius, despite the widespread loss of native vegetation. The caterpillars are able to survive on cultivated Citrus spp., but native habitat is virtually restricted to the Black River Gorges. Skinks Gongylomorphus bojesi and geckos Phelsuma spp. also occur.

ZONING/CONSERVATION MANAGEMENT None, apart from the partitioning into numerous smaller reserves. Several very small areas have been cleared of gregarious exotic weeds in order to free native plants which were being smothered. It is proposed that parts of the area should be fenced as weeded reserves. Hibiscus columnaris is being propagated by the Forestry Department and grows easily from cuttings, although it is almost extinct from the wild. Under the sponsorship of ICBP, WWF and the New York Zoological Society (IUCN/WWF Project 1082), an intensive programme of captive breeding has been initiated for the Mauritius kestrel, parakeet and pink pigeon. A reduction in introduced species, such as exotic birds and macaques Macaca sp., may be necessary to ensure the safety of the kestrels, parakeets, pink pigeons and cuckoo-shrikes. Translocation of fodies to Réunion has been proposed by the British Ornithologists Union (BOU) (Procter and Salm, 1975). The Forestry Service has already started planting nectar-producing flowers along the roadsides to improve the habitat for white-eyes.

STAFF Ten forest officers

LOCAL ADMINISTRATION Conservator of Forests, Ministry of Agriculture and Natural Resources and the environment, Forestry Service, Curepipe.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research in the area dates from the 1930s. Future research could investigate the total ecological effects of exotic plant establishment. Herbarium facilities are available.

MODIFICATION OF THE NATURAL ENVIRONMENT Parts of the reserve are leased for the shooting of deer, which have free access to the reserve and which are inhibiting regeneration. Several forest roads bisect the area and tourism is increasing. The forest is badly invaded with exotics like Psidium cattleianum, Rubus alcaefolius and Ligustrum robustum var. walkeri. There are four main threats to the bird species in the reserve: (1) Reduction in the area of mature evergreen forest. (2) Nest predation by introduced macaques and rats. (3) Shooting by careless or uninformed hunters. (4) Possible competition for nest holes by the aggresive introduced rose-ringed parakeet Psittacula krameri, and common mynah Acridotheres tristis with the Mauritius parakeet. These two introduced species and the red whiskered bulbul Pycnonotus jocosus are invading the native forests.

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Reserva de Mapimi

BIOGEOGRAPHICAL PROVINCE 1.09.07 (Chihuahuan)

LEGAL PROTECTION For the time being, all hunting has been voluntarily suspended, especially that of the desert tortoise. The peasants enforce this ban.

DATE ESTABLISHED January 1977 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Situated north-east of the town of Ceballos in the point formed by the boundaries of the states of Durango, Chihuahua and Coahuila. The reserve lies in a hollow or basin surrounded by small mountain ranges running more or less parallel from north to south in the large catchment area known as Bolson de Mapimi; 26°29'-52'N, 103°56'W.

ALTITUDE 1,100-1,350m

AREA 100,000ha

LAND TENURE There are various common public lands and ranches. A company has been formed under the direction and authority of the Government of the State of Durango and the scientific direction of the Institute of Ecology. It comprises the public authorities and graziers in the area and the appropriate federal authorities.

PHYSICAL FEATURES The reserve is part of the endorheic system of the Mapimi Bolson of the North Mexican Central Tableland. Alluvial deposits predominate, consisting of recent Pleistocene gravels, clays and muds. Outcrops of igneous rock from the Tertiary period and volcanic rocks (rhyolites, andesites and basalts) are also found. There are isolated mountains and extensive interconnected plains, and a spring in the core zone. There is an arid tropical highland climate with an average annual rainfall of 200mm. The mean monthly temperature varies between 11.2°C and 28.4°C, the coldest is 1.5°C in January.

VEGETATION The reserve belongs to the Chihuahua arid zone, with a large quantity of endemics. Microphyllous shrub species give the reserve its character. Larrea sp. is the characteristic plant determining the general physiognomy of the area, together with fleshy-leaved species (Agave spp., Hechtia spp.), thick-stemmed species (Pastinaca spp.) and large expanses of mesquite Hilaria mutica and the dropseed Sporobolus airloides in the bottom lands.

FAUNA The pronghorn antelope Antilocapra americana disappeared in the 1940s. The mule deer Odocoileus hemionus, the gopher tortoise Gopherus flavomarginatus, the coyote Canis latrans, the lynx Felis rufus and the puma F. concolor are characteristic. There is a rich fauna adapted to the arid conditions.

ZONING/CONSERVATION MANAGEMENT There is a core zone surrounded by a buffer area.

STAFF 14 research workers, eight research assistants and technicians, and seven students are engaged in research work.

LOCAL ADMINISTRATION Instituto de Ecologia. Apartado Postal 18-845, Mexico 18, D.F.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Several institutions (foreign and domestic) are already undertaking a large number of studies. Examples include the study of herpetofauna, ecophysiology of dominant reptile species, study of the biology of the desert tortoise, study of the biology of raptorial birds, and regeneration of desert vegetation after over-grazing, fire and various types of human activity. With the help of associations of bee-keepers, it is planned to subsidize certain young "ejidatarios" (communal farmers) so that they can learn the techniques of bee-keeping based on the flowers of desert plants. At San Ignacio there is a camp near the only spring in the zone, and a desert laboratory has been built in the 20ha of desert belonging to the Institute of Ecology, San Ignacio. Light aircraft and motor vehicles will be readily available from the Government of the State of Durango and camping equipment has been provided by the Secretariat for the National Heritage.

LOCAL POPULATION There are clever production units in the reserve, three of which are privately owned while eight are ejidos in which the land is entrusted by the Government to a local community. Nine of the units are devoted to stock-raising, one is devoted to the extraction of wax from Candelilla Euphorbia antisyphilitiea while the 11 extracts salt from a lagoon to the north of the reserve. Agricultural development is rudimentary for the most part and the availablility of water varies widely. Strong efforts have been made to involve the local inhabitants both through the application of results of research within the reserve to stock-raising practices and by making the protection of the reserve their responsibility.

MODIFICATION OF THE NATURAL ENVIRONMENT The region has been little disturbed, except for sporadic hunting and, to a lesser degree, extensive stock raising.

PRINCIPAL REFERENCE MATERIAL

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Reserva de la Michilia

BIOGEOGRAPHICAL PROVINCE 1.21.12 (Madrean-Cordilleran)

LEGAL PROTECTION No information

DATE ESTABLISHED January 1977 as a Biosphere Reserve

GEOGRAPHICAL LOCATION 75km to the south of the town of Durango in the Sierra de Michis, a branch of the Sierra Madre Occidental. On the north-east is the town of Vicente Guerrero, on the west the village of Mezquital, and on the south-east the Sierra de Urica, which is the boundary between the States of Durango and Zacatecas. 23°27'N, 104°15'W.

ALTITUDE 2,250-2,850m

AREA 42,000ha

LAND TENURE The core area (Cerro Blanco) is owned by the government of the State of Durango who will transfer it to the Institute of Ecology. The buffer zone contains the communal farm (Ejido) of San Juan de Michis and ranches owned by small graziers.

PHYSICAL FEATURES The Sierra de Michis consists of igneous rock of the Tertiary period. The geological basis of the La Michilia plateau is acid rock (tuff). Particularly in the reserve proper, the topography is marked by a high degree of relief. The soils range from acidic and igneous rock to sandy clay, and on the slopes are stony. There are several ephemeral streams and lagoons, besides the two permanent streams, Laurel to the west and Temascal to the south-east. There are also marshy meadows in the core area. The annual rainfall ranges between 500mm and 700mm, and the average annual temperature varies between 12°C and 28°C, with extremes between -3°C and 28°C.

VEGETATION A pine and holm oak forest takes up the greater part of the reserve proper and the buffer area, consisting of associations of Pinus lumholtzii and Quercus rugosa, with Arctostaphylos polifolia and Juniperus durangensis. There are also holm oak and pine forests with associations of Quercus chihuahuensis, Q. siderofila, Q, fulva, Pinus arizonica, P. engelmanni and P. ayacahuite. Generally speaking, where the soil is not very deep, on the slopes, it is covered with chaparral vegetation characterized by dense clumps of Arctostaphylos pungens, isolated species of Quercus potosina and Q. rugosa. There are also natural pastures of Aristida spp., Panicum spp., Bromus spp., Senecio spp. and Stevia spp..

FAUNA Two species of native fauna have decreased to the point where they are very rare: black bear Ursus americanus (which was hunted until about 15 years ago) and wolf Canis lupus (occasionally hunted). The important species are white-tailed deer Odocoileus virginianus, puma Felis concolor, collared peccary Tayassu tajacu, coyote Canis latrans and turkey Meleagris gallopavo. Otter Lutra longicaudis are found in the stream Temascal. A few examples of military macaw Ara militaris remain.

ZONING/CONSERVATION MANAGEMENT Core zone of 7,000ha in which the fauna and flora are completely protected. In the buffer zone of 35,000ha stock-raising and controlled hunting are permitted.

STAFF 29 research workers, two research aassistants and five students. The inhabitants of the zone cooperate in the protection of the reserve.

LOCAL ADMINISTRATION Instituto de Ecologia, Apartado Postal 18-845, Mexico 18, D.F.

SCIENTIFIC RESEARCH AND FACILITIES Four Mexican and two foreign institutions are involved in research at La Michilia. Present studies include the feeding habits of the white-tailed deer Odocoileus virginianus, development of new crops such as strawberries, the agricultural potential of the area, its ornithology and botany. A house near Cerro Blanco has been made available by Senor Eduardo de la Pena, and another on the communal farm of San Juan de Michis. Transport facilities are provided by the government of the state.

LOCAL POPULATION An association is being formed, under the control of the government of the State of Durango and the scientific direction of the Institute of Ecology, to coordinate the activities of the communal farm and the small graziers in order to protect the fauna and flora and to test new systems for the management of the natural resources. The appropriate federal authorities will participate in this association.

MODIFICATION OF THE NATURAL ENVIRONMENT The Cerro Blanco contains natural formations which remain unaltered. The rest of the area shows some signs of disturbance following hunting, very restricted farming, utilization of the forest and some stock raising.

PRINCIPAL REFERENCE MATERIAL

Informes del Programa Nacional Indicativo de Ecologia Tropical (1976). National Board of Science and Technology, Mexico.

Baker, R. and Keever, J. (1962). Mammals of the Mexican State of Durango. publ. Mus. Mich. State Univ. Biol. Ser. 2: 25-146.

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Montes Azules

BIOGEOGRAPHICAL PROVINCE 8.01.01 (Campechean)

LEGAL PROTECTION Created by Presidential Decree of 12 January 1978.

DATE ESTABLISHED Accepted as a Biosphere Reserve May 1979.

GEOGRAPHICAL LOCATION Located in the region known as Selva Lacadona in the State of Chiapas in south-east Mexico, between the Lacantum amd Locania rivers; 16°09'-16°53'N, 90°30'-91°45'W.

ALTITUDE 350-1,400m

AREA 331,200ha

LAND TENURE Mixture of federal, communal and some private lands

PHYSICAL FEATURES Ranges of small hills and valleys with rivers and small lakes on calcareous soils.

VEGETATION Perhaps the largest area of humid tropical forest in Mexico and Central America but also areas of pine forest in higher altitudes and montane rain forest. The reserve and surrounding forest contain some 500 species of tree.

FAUNA There are a number of important species of mammal: jaguar Panthera onca (V), margay Felis wiedii (V) and ocelot F. pardalis (V), collared peccary Tayassu tajacu, Baird's tapir Tapirus bairdii, spider monkey Ateles geoffroyi (V) and howler monkey Alouatta palliata. Also Crocodylus moreletii, harpy eagle Harpia harpyja (R), scarlet macaw Ara macao and great curassow Crax rubra.

ZONING/CONSERVATION MANAGEMENT No zoning has yet been established inside the biosphere reserve, but it is surrounded by a forest reserve of 2,612,300ha.

STAFF None full-time, but five researchers part-time.

LOCAL ADMINISTRATION Programme MAB Mexico, Secretaria Forestal y de la Fauna, c/o Secretaria de Agricultura et Recursos Hidraulicos, Insurgentes Sur No. 476 D.F.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There have been surveys of geology, soils, archaeology, mammals, birds, insects, plants and soil fauna; and there are plans for cooperative research between the government and the universities. There are no research facilities yet, but a laboratory is planned.

MODIFICATION OF THE NATURAL ENVIRONMENT More recently the forest has been exploited for chichle and mahogany, but has not been seriously altered by this, but wood clearing is recognised as a serious threat. Invasion by landless peasants is also a problem. Forest is cut down, temporarily and unproductive agricultural systems are initiated which break down as a result of poor returns and land is turned into pasture.

PRINCIPAL REFERENCE MATERIAL
A book is in press in which available information is assembled.

Omo Strict Natural Reserve

BIOGEOGRAPHICAL PROVINCE 3.01.01 (Guinean Rain Forest)

LEGAL PROTECTION Protection against all forms of exploitation is provided under the Forest Reserves Act.

DATE ESTABLISHED Established as a strict natural reserve in 1949. Approved as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION North of Oshokum, 4km from Etemi village in the Ijebu-west Division of Ogun State. The strict nature reserve lies within Omo Forest Reserve. 6°30'N, 4°15'E.

ALTITUDE 100m

AREA 460ha (strict natural reserve)

LAND TENURE State

PHYSICAL FEATURES The land is highest in the west and slopes gently towards the south and east, becoming fairly flat on the banks of the Omo River. The geological strata consist of crystalline rocks of undifferentiated basement complex. Soil is heavy clay formed from weathered granite, except where thick alluvium has been laid down by the river on its banks. There are many small streams, which fill with water during the rainy season, but are dry in the dry season. The mean annual rainfall is 2030mm.

VEGETATION The reserve lies in the moist lowland evergreen forest zone. The forest is mainly open with common species including: Diospyros spp., Strombosia pustulata, Scottellia coriacea, Octolobus angustatus, Corynanthes pachyceras, Canthium vulgare, Terminalia superba, Hunteria umbellata, Xylopia aethiopica, Ficus spp., Funtumia elastica, Drypetes spp., Cola spp., and Khaya ivorensis. Sterculia rhinopetala is locally abundant. Most of the western area is broken forest. There are several Uvaria spp. tangles with isolated trees, usually Terminalia superbai Nauclea diderrichii, Strombosia pustulata, Canthium vulgare, Cordia millenii and Funtumia elastica, rising above the general level. Areas of good, high forest include: Nauclea diderrichii, Brachystegia nigerica, Scottellia coriacea, Khaya ivorensis, Canthium vulgare, and Strombosia pustulata. Where light penetrates, clumps of seedlings occur. Common regenerating species are Drypetes spp., Octolobus spp., Cola spp., Sterculia rhinopetala, Buchholzia coriacea, Brachystegia nigerica, Guibourtia ehie, Musanga spp., and Diospyros spp. Anthonotha macrophylla, Grewia coriacea, and Spondianthus preussii are common in the marshy areas.

FAUNA Common mammals include elephant Loxodonta africana (T), duikers Cephalophus spp, antelopes and warthog Phacochoerus aethiopicus. The red-bellied monkey Cercopithecus erythrogaster is also present.

ZONING/CONSERVATION MANAGEMENT Central core (strict natural reserve) surrounded by buffer zone (forest reserve). The core area is still largely undisturbed. Very little is known about the past history of the area, but an old hauling road from Etemi to Etemi Odo indicates former exploitation.

STAFF Five assigned to maintenance and two to research

LOCAL ADMINISTRATION The Director, Forestry Research Institute of Nigeria, PMB 5054, Ibadan.

SCIENTIFIC RESEARCH AND FACILITIES The Forestry Research Institute of Nigeria have carried out a biological inventory in the area and visiting scientists from overseas have studied the ecology. MAB Projects 1 and 2 include productivity and regeneration studies .

MODIFICATION OF THE NATURAL ENVIRONMENT There is a settlement of about 10 people 30km from the reserve. Traces of carbide powder used by hunters can usually be found within the buffer zones and along the reserve boundaries. The new main road from Shagamu to Benin (A121) passes through the forest reserve. Gmelina spp. plantations are replacing rain forest in the forest reserve which threatens the effectiveness of the strict natural reserve.

PRINCIPAL REFERENCE MATERIAL

No information

Northeast Svalbard Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.25.09 (Arctic Desert)

LEGAL PROTECTION Total

DATE ESTABLISHED Established as a Nature Reserve on 1 June 1973 by Royal Decree. Approved in June 1976 as Biosphere Reserve.

GEOGRAPHICAL LOCATION Northeast Svalbard, including the islands of Nordaustlaudet, Kvitoya, Kong Karls Land, several smaller ones and all surrounding territorial waters. 78°40'-80°50'N, 16°-35°E.

ALTITUDE 0-835m

AREA 1,555,000ha

LAND TENURE Norwegian government

PHYSICAL FEATURES About 80% of the surface of the biggest island, Nordaustlandet, is icecap or glaciers. The area has a complex geology with dolerites, shales and tillites, limestones and dolomites, sandstones, siltstones, homogeneous granites, quartz porphyries, mixed metasediments, metavolcanic rocks, granitic gneisses and migmatities. There is high arctic climate with annual precipitation under 400mm. A branch of the North Atlantic Drift reaches Svalbard, keeping water open during summer. Monthly means range from about -12°C to 4°C. There is midnight sun from about 20 April to 20 August.

VEGETATION Most of the land area is ice-covered or barren but vegetation is typical of high arctic tundra. The reserve represents some of the northernmost habitats for many species. Eighty-three vascular species (about 50% of the total flora) have been identified on Nordaustlandet constituting a mixture of shoreline communities, marsh and aquatic communities, vegetation on moving soil and cliff and tundra communities. Nothing is yet recorded about the composition of the marine flora.

FAUNA One of the main reasons for setting up the reserve was to effectively preserve the polar bear Ursus maritimus, for which this is the main denning area in the archipelago (Larsen, 1976). Other common mammals include arctic fox Alopex lagopus, walrus Odobenus rosmarus, ringed seal Phoca hispida and bearded seal Erignathus barbatus. The reserve is an important breeding site for the walrus with an estimated population in 1973/4 of 300-400. The local subspecies of reindeer Rangifer tarandus spetsbergensis survives more extreme conditions in the reserve than anywhere else in the archipelago. Seventeen bird species breed regularly including Brünnich's guillemot Uria lomvia nesting in one of the largest seabird colonies in the islands.

CULTURAL HERITAGE Trapping has been the main human ifluence in the past, this area being so cold and remote.

ZONING/CONSERVATION MANAGEMENT None The area is so remote that little positive management is necessary but regulations have been made to guard against future interference. Construction, mining and all fishing except shrimp trawling in waters over 100m deep are prohibited, and wildlife totally protected.

STAFF None, but supervision of the reserve at local government level is vested in the Sysselmannen pa Svalbard, 9170 Longyearbyen, Svalbard.

LOCAL ADMINISTRATION Enquiries to: International Division, Ministry of the Environment, Myntgaten 2, Oslo-Dep., Oslo 1.

VISITOR FACILITIES None

SCIENTIFIC RESEARCH AND FACILITIES A variety of geological, glaciological, botanical and zoological studies have been carried out, mainly in summer. WWF Project 348 supported investigations of polar bears from 1966 to 1971. One wintering station was operating during the International Geophysical Year and a few hunters' huts exist. All provisions must be taken, as none are available in Svalbard. The main institution working here is the Norsk Polarinstitutt, Rolfstangveien 1330, Oslo Lufthven, Norway.

LOCAL POPULATION There is a small population in southern Svalbard.

MODIFICATION OF THE NATURAL ENVIRONMENT Pollution generally is increasing in the Arctic, including a lack of waste disposal by expeditions.

PRINCIPAL REFERENCE MATERIAL

Anon. (1981). Environmental Regulations for Svalbard. Ministry of Environment, Oslo.

Larsen, T. (1976). Landscape and Habitat Protection in Svalbard. Nature and National Parks 54: 15-17.

WWF Project 348. International Polar Bear Programme in Svalbard (Spizbergen) - Norwegian Expedition 1968/1969.

Lal Suhanra National Park

BIOGEOGRAPHICAL PROVINCE 4.15.07 (Thar Desert)

LEGAL PROTECTION The area is fully protected; furthermore, hunting and cutting of vegetation is prohibited within a 5km radius of the park's boundary (Sheikh, 1982). The plantation has been a reserved forest since 5 July 1947 although its legal status appears to be uncertain (Masud, 1980).

DATE ESTABLISHED 26 October 1972 (Government of Punjab Notification No. SOF (EXT)XII-23/72), following recommendations made by the Wildlife Enquiry Committee in 1971. The Cholistan Desert was originally preserved as a hunting ground by the nawabs of the former state of Bahawalpur. Subsequently, in 1968, it was declared a game reserve. Declared a Biosphere Reserve in 1977.

GEOGRAPHICAL LOCATION Lies in the south-east of Punjab Province, 32km north-east of Bahawalpur City along the Bahawalpur-Bahawalnagar road. Approximately 27°30'N, 72°20'E.

ALTITUDE 110m

AREA 31,355ha, comprising 20,932ha of desert, 8,488ha of irrigated forest plantation and 1,934ha of reservoir. (The area is being enlarged by an additional 22,680ha.)

LAND TENURE Provincial government

PHYSICAL FEATURES The Cholistan Desert is relatively flat and interspersed with sand dunes up to 1,000ha in extent and 4m in height, some of which are unstable. It is crossed by the dried-up bed of the Hakra River. Desert Branch Pond, which was originally built for storing surplus flood waters, is shallow (1.5-4m) and contains 11 small islands and two larger ones of 30ha and 45ha, which are used by migratory waterfowl in winter. The depth of the water table (3-12m below ground level) varies directly with the distance from Bahawal Canal. The soil is predominantly sandy loam, with clay flats (dhars) between the sand dunes. The climate is of the arid sub-tropical continental type, characterised by low sporadic rainfall, hot summers, low relative humidity, high rate of evaporation, strong summer winds and mild winters. There are five distinct seasons: winter (December-February), spring (March-April), summer (May-October), autumn (November) and monsoon (July and August). Climatic data are available from Gahawalpur for the period 1946-1962. The mean annual precipitation was 214mm in 1946-1962, mean monthly maximum temperature highest (46.1°C) in May and mean month minimum temperature lowest (-0.2°C) in January (Masud, 1980).

VEGETATION The predominant vegetation in the desert comprises scattered bushes of *Tamarix* spp. and *Calligonum polygonoides*, with *Acacia* sp. forming tall trees in the clay flats. The plantation, which is irrigated by the desert branch of the Bahawal Canal, consists mainly of shisham *Dalbergia sisso*, together with toot *Morus alba*, kikar *Acacia arabica*, frash *Tamarix articulata*, jal *Salvadora oleoides*, jand *Prosopis spicigera*, karir and jandi *Prosopis glandulosa*. Of the numerous herbs, khubal *Cynodon dactylon* and puth kanda *Achyranthes aspera* are important. Vegetation grows profusely on the islands of the reservoir. Dense stands of kana *Saccharum spontaneum* grow along the margins and *Salvinia* sp. tends to cover the surface of shallower waters (Sheikh, 1982). Some 135 species of plants have been recorded in the park, 39 of which are known for their medicinal properties (Anon., n.d.).

FAUNA Blackbuck Antilope cervicapra became virtually extinct in the Cholistan Desert but the species has been re-introduced within large enclosures, together with chinkara Gazella gazella, nilgai Boselaphus tragocamelus, hog deer Cervus porcinus and Indian rhinoceros Rhinoceros unicornis (Roberts, 1975; Sheikh, 1982). Other mammals present include long-eared hedgehog Hemiechinus auritus, wolf Canis lupus (V), jackal C. aureus, Bengal fox Vulpes bengalensis, common desert fox V. vulpes, ratel Mellivora capensis, otter Lutra perspicillata, small Indian civet Viverricula indica, Indian grey mongoose Herpestes auropunctatus, caracal Felis caracal, jungle cat F. chaus, desert cat F. libyca, wild boar Sus scrofa, Indian crested porcupine Hysterix indica and Indian hare Lepus nigricollis (Masud, 1980). Of the 63 species of birds recorded within the park (Anon, n.d.), white-eyed buzzard Butastur teesa, black partridge Francolinus francolinus, grey partridge F. pondicerianus, purple moorhen Porphyrio porphyrio, pied crested cuckoo Clamator jacobinus, Indian great horned owl Bubo bubo, spotted owlet Athena brama, crow pheasant Centropus sinensis, blue-cheeked bee eater Meropes superciliosus, red-winged bush lark Mirafe eruthroptera and wire-tailed swallow Hirundo smithi are noteworthy. The reservoir, a resting place for some 25 species of migratory waterfowl on the Indian flyway, contains large fish populations of carp (Cyrinidae), catfish (Siluriformes), catla Catla catla, murrel Ophicephalus marulius, rohu Labeo rohita, mullet Vallago attu, mirgal Cirrhina mirgala and trikanda Rota rita. Reptiles include turtles, tortoise, monitor lizards Varanus spp., lizards of the genus Calotes, cobra Naja naja, saw-scaled viper Echis carinatus, krait Bungarus sp., watersnake, gamasnake Boiga sp., wolfsnake Lycodon sp. and John's sand boa Eryx johni. Due to the irrigated plantation and reservoir, the park is infested with mosquitoes throughout much of the year.

CULTURAL HERITAGE There are archaeological remains of an ancient civilization which once flourished along the Hakra River.

ZONING/CONSERVATION MANAGEMENT A system of zonation has been proposed, whereby areas receive differing intensities of use by visitors. The entire Cholistan Desert is incorporated within a wilderness zone in which development is not permitted. Enclosures established for the blackbuck breeding programme are included within special areas, to which entry is restricted. An intensive-use recreation zone encompasses the area within 4km of the Desert Branch Canal and is surrounded by a modest-use recreation zone (Masud, 1980). The area was identified as being suitable for breeding blackbuck and as an important wetland site in 1966 (Mountfort and Poore, 1967), since when its conservation status has progressively been upgraded. Objectives outlined in the management plan include protecting and restoring the endemic fauna and flora, providing recreational and educational facilities for the local people (and also for tourists) and accommodating scientific research. The plantation is being managed for commercial purposes according to objectives outlined in the working plan (Qazi, 1967). Of the additional 5,100ha earmarked for plantation by 1987/88, 1,862ha has already been planted with trees (Shah, 1984). The programme to re-introduce blackbuck to the park began in 1970 with an initial shipment of ten animals (seven females and three males) from a Texas ranch. (These blackbuck were probably the descendants of 35 blackbuck presented to Texas in 1940 by the late Amir of Bahawalpur.) Survival of young proved to be low and so, in 1980, a further five females and one male, donated by Copenhagen Zoo, were added to the stock, since when numbers had increased to some 48 by 1982. Another breeding nucleus was established in a separate enclosure in 1982 with animals from Copenhagen Zoo and Western Plains Zoo, New South Wales (Sheikh, 1982). Marbled teal, provided by the Waterfowl Trust, Slimbridge, U.K., were re-introduced in 1970 (Bokhari, 1970b).

STAFF Comprises an administrator with an office wing of 11 staff, a forestry wing of 71 staff (including one divisional forest officer, three range officers, ten foresters and 18 forest guards) and a wildlife wing of 12 staff (including one assistant game warden, one game inspector, three game watchers and two fishery watchers) (Shah, 1984).

LOCAL ADMINISTRATION Administrator, Lal Suhanra National Park Head Office, Bahawalpur, Punjab Province.

VISITOR FACILITIES The park is accessible from the Bahawalpur-Bahawalnagar road. There is a visitor centre and children's park near the main entrance. Overnight accommodation is available at Hermitage Rest House by the reservoir, the Irrigation Department's lodge on Whispering Hill and at the new tourist hut beside the Desert Branch Canal. Other facilities include four camp sites, two watch towers, two fishing sites and boating on the reservoir (Masud, 1980; Shah, 1984).

SCIENTIFIC RESEARCH AND FACILITIES The availability and selection of food by blackbuck has been studied (Mirza and Waiz, 1973). A study of the behaviour of chinkara and blackbuck is in progress, jointly supported by Punjab Government and U.S. Fish and Wildlife Service.

LOCAL POPULATION About 20 families cultivate some 810ha of land in the vicinity of the reservoir.

MODIFICATION OF THE NATURAL ENVIRONMENT The plantation comprises mostly introduced species, including the dominant shisham, toot, simal Salmalia malabaricum and Eucalyptus spp.. Problems of encroachment exist in several places and some areas continue to be cultivated. The reservoir could be expanded in the future with the increased demand for water to irrigate the Cholistan Desert as it becomes more extensively colonised (Masud, 1980).

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Parque Nacional Fronterizo Darién

BIOGEOGRAPHICAL PROVINCE 8.02.01 (Panamanian)

LEGAL PROTECTION Total

DATE ESTABLISHED 7 August 1980 by Presidential Decree No. 21. Accepted as a World Heritage Site in 1981. Established as a Biosphere Reserve in 1983. The area has been protected since the establishment of Alto Darien Protection Forest (700,000ha) under Decree No.84 in 1972.

GEOGRAPHICAL LOCATION The park is located in the province of Darien to the east of Santa Fe and the Gulf of San Miguel and covers the region adjacent to the Colombian border, extending along about 80% of the border and includes part of the Pacific coast. 7°12'-8°31'N, 77°09'-78°25'W. Apparently the boundaries still remain to be legalized by decree.

ALTITUDE 0-1,500m

AREA 597,000ha

LAND TENURE Over 90% national land; 10% traditional agriculture by Chocoe and Cuna Indians

PHYSICAL FEATURES This park is in a unique situation, forming the bridge between the two continents of the Western Hemisphere, which has emerged from below sea level on several occasions in the distant past, most recently in the early Pleistocene. The eastern part is primarily of volcanic origin covered with sedimentary rock of the Cenozoic period. The most important geomorphic characteristic is the north-east - south-east geosincline which is bordered by raised folds and high mountains which are a principal feature of the park. The Pacific tides (from 3.8m to 6.1m) affect the Chucunaque and Tuira rivers for many kilometres inland twice daily. There are beaches, rocky coasts, freshwater marshes and swamps within the Park. Mean annual temperature 26°C and annual rainfall 2500-3500mm on the Atlantic side and 1,800-2500mm in the central part of the area and on the Pacific side. Natural erosions have resulted in numerous landslides with deep cuts and gorges.

VEGETATION Darien contains a wide range of habitats: sandy beaches, rocky coasts, mangroves, freshwater marshes, palm forest swamps and lowland and upland moist tropical forest. The Darien forests have been characterized by scientists as the most diverse ecosystems of tropical America and are still relatively undisturbed. The eroded landslides and associated gorges have given rise to successional plant communities with major tracts of primary and secondary forests covering most of the terrain. The average height of the monsoon forest is approximately 40m with occasional dominant trees reaching 50m and the most common species in the area is the "cuipo" Cavanillesia platanifolia. Premontane and montane forest occur above 200m with several types of botanically interesting ecosystems including cloud forest and the elfin forest of Cerro Pirre. The wetland forest along the Chucunaque and Tuira rivers is often covered by pure stands of "cativo" Priona copaifera, this species being the most utilized timber tree in the region. There are some mangroves along the Pacific coast, the more common species being Rhizophora mangle, Avicenia nitida, Laguncularia racemosa, Mora oleifera and Pterocarpyus officinalis.

FAUNA There have been few studies of the fauna. Mammals include the bush dog Speothos venaticus (V), giant anteater Myrmecophaga tridactyla (V), jaguar

Panthera onca (V), ocelot Felis pardalis (V), capybara Hydrochaerus hydrochaeris, douroucoulis Aotus trivirgatus, howler monkey Alouatta villosa, brown-headed spider monkey Ateles fusciceps, and Baird's tapir Tapirus bairdii (V). The harpy eagle Harpia harpyia (R) also occurs in the park as do the crocodilians Caiman crocodilus (V) and Crocodylus acutus (E).

CULTURAL HERITAGE The area is both anthropologically and historically rich, with two major indigenous groups: Chocos (1,000 Emberas and Vainanas) and Kunas (200), and a number of smaller groups still living by traditional practices. The area was first visited by Spanish conquistadores and was explored along the coast by Christopher Columbus in 1502. In 1510, the town of Santa Maria la Antigua del Darién was established probably somewhere within boundaries of the park. As a result of the Spanish presence and mistreatment, many of the Indians moved away. Today, conservation of cultural resources such as the Indian populations is included as a management objective for the park.

ZONING/CONSERVATION MANAGEMENT Strictly protected core zone of over 83,000ha; very extended "cultural" or man-used zone of over 180,000 ha, containing Indian populations who have kept their traditional way of life and culture; a development zone of some 8,000ha for tourism and environmental education is proposed; an inspection zone (20% outside the Park) 40km wide runs along the Panama/Columbia border. During 1977/78 RENARE, COPFA and the CATIE Wildlands and Watershed Project developed a detailed Master Plan for the National Park including a zoning scheme. With the continued help of RENARE the first stages of the plan were implemented which included formation of a core of full-time trained Park staff; selection of key guardpost sites; planning and initiation of an environmental education - public relations programme; involving the indigenous population in park planning and management; and visits to key areas to collect information on the geography, mapping, ecology, socio-economy and ethnography. There are 10 inspection guardposts patrolled by the Commission for the Control of Foot and Mouth Disease (COPFA). Short term annual operational plans are also prepared.

STAFF One superintendent, one District Chief (in Jaque) and four full time wardens (all Chocoe Indians)

LOCAL ADMINISTRATION Biol. Ramon Alvarado, National Parks and Wildlife Department, RENARE, Apartado 2016, Ciudad de Panama.

VISITOR FACILITIES Access is by river and heavy truck. There are no reports of facilities.

SCIENTIFIC RESEARCH AND FACILITIES Only a few studies have been published which are concerned mainly with the flora, vegetation and general ecology of the area. The area is of great scientific interest for both natural and social sciences due to its diversity of natural ecosystems and cultural features. RENARE has constructed administration/living-quarters in Yaviza, near the park which have limited scientific use.

LOCAL POPULATION Approximately 1200 Indians live along the edges of the rivers. On the western boundary of the park there are a number of small farming plots whose owners have no title deeds.

MODIFICATION OF THE NATURAL ENVIRONMENT The Pan-American Highway, which is under construction, bisects the park. This opens up the area for settlement and greatly increases the danger of transmitting foot and mouth disease from South American cattle into Central America. The influx of people may lead to

uncontrolled forestry and agriculture and hunting resulting in deforestation, soil erosion and disruption of the fragile ecological equilibrium. Some precautions and regulations for the potential impact have been implemented. The towns of El Real and Boca de Cupoe are very close to the area and the majority of their inhabitants have small farms inside the park. There are very limited areas of agriculture and disturbed forest near the Chocoe and Cuna Indian villages, principally along river courses.

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Reserva de Huascaran

BIOGEOGRAPHICAL PROVINCE 8.37.12 (Southern Andean)

LEGAL PROTECTION The national park core zone is legally protected but there is no protection for the surrounding 'influence zone' which is a part of the Biosphere Reserve.

DATE ESTABLISHED The national park was established on 1 July 1975 by Supreme Decree no. 0622-75-AG (under the law on forests and wildlife, Decree-law no. 21147). Accepted as a Biosphere Reserve by Unesco on 1 March 1977.

GEOGRAPHICAL LOCATION Located in the Cordillera Blanca, in the Sierra Central of Peru in the Department of Ancash in the Andes. The park spans parts of the provinces of Recuay, Huaraz, Carhuaz, Yungay, Huaylas, Pomabamba, Mariscal Luzuriaga, Huari Corongo, Sihuas and Bolognesi. 08°50'-10°40'S, 77°07'-77°49'W.

ALTITUDE 2,500-6,768m

AREA The national park covers 340,000ha; the Biosphere Reserve, covering 399,239ha, includes the national park together with 39,590ha in a northern modified zone, 19,460ha in a southern modified zone, and 189ha in a Predio Luna modified zone.

LAND TENURE The majority of the park belongs to the State, but it also contains five properties conceded to the SAIS Atusparia, and seven farming communities. In the 'influence zone' there is local community ownership with the northern modified zone entirely occupied by farming concerns, while the southern modified zone is occupied by small grazers.

PHYSICAL FEATURES The park encloses a diversity of geomorphological features. It is situated in the Cordillera Blanca, the highest tropical mountain range in the world, with 27 snow-capped peaks 6,000m above sea level, of which El Huascaran (6,768m) is the highest peak in Peru (these mountains are internationally famous for mountaineering). The deep ravines carry rushing torrents derived from one of the 30 glaciers, and there are some 120 glacial lakes ranging in capacity from one to ten million cubic metres of water. The lowest point in the reserve is the Grand Cataract near the northern boundary. The base rock consists principally of sediments from the Upper Jurassic seas and of the Cretaceous, and Tertiary volcanic deposits which make up the Andean batholiths. There is still some activity in the area; this area was affected by an earthquake in 1970, and there are three thermal springs which are utilised lower down their course for their therapeutic properties. The mean annual temperature is about 3°C, the minimum being -30°C. Mean annual precipitation is approximately 884mm (recorded at 3,980m), falling mainly in October-May.

VEGETATION The wide topographic range supports an equally wide range of vegetation types, humid montane forest in the valleys, with nival, alpine fluvial tundra, and very wet sub-alpine paramo formations at higher levels. Some 120 species of plants have been identified. Puya raimondii, a distinctive alpine bromeliad, is abundant together with other Bromeliaceae species, mountain orchids (Orchis spp., Masdevalia spp.) and relict forests of Polylepis spp. and Gynoxys spp..

FAUNA The spectacled bear Tremarctos ornatus (V), puma Felis concolor incarum, mountain cat F. pajeros, white-tailed deer Odocoileus virginianus and

the vicuna Vicugna vicugna (V) are important indigenous species, but all have been heavily hunted in the past. The North Andean huemul Hippocamelus antisensis (V), is also noteworthy. Among the birds the most noteworthy are Gurney's Buzzard Buteo poecilochrous, Andean condor Vultur gryphus, giant hummingbird Patagona gigas peruviana, giant coot Fulica gigantea and ornate tinamou Nothoprocta ornata.

CULTURAL HERITAGE The Cordillero region has been the site for centuries for the settlement of ethnic groups, as witnessed by ruins at Gekosh and Chuchumpunta and at Willcahuain-Huyllap-Pumacayan, Hechkap-Jonkapampa and others. These represent the largest collection of such remains in the world known to date. The most ancient cultures seem to have developed in the northern part of the park; the remains at the Cueva del Guitanero in Yungay date back 2,000 years before the Chavin culture, spreading from Carhuaz to Pomabamba.

ZONING/CONSERVATION MANAGEMENT There is no official zoning within the park, although there are designated camp sites and footpaths. The Biosphere Reserve has the national park as its core zone, with the modified zones as buffers. Some work has been done on the preparation of a mangement plan, but there is no officially approved document as yet. The budget is insufficient at present to provide maintenance and environmental conservation services (World Heritage nomination, 1984). Several guardposts have been constructed.

STAFF One director, one technical assistant, two rangers, two patrol men, one driver, one secretary, several labourers. There is also a detachment of the Forest Police.

LOCAL ADMINISTRATION ORDENOR-CENTRO, Direccion Regional Agricultura y Alimentacion, Proyecto Parque Nacional Huascaran, Av. Las Américas S/NO, Huaraz.

VISITOR FACILITIES The park is popular with mountaineers and there is a well developed system of trekking and mountaineering routes; the largest concentration in Peru. There is a small visitor centre, hostel and campsite in the park.

SCIENTIFIC RESEARCH AND FACILITIES There is currently no formal research or monitoring programme although research has been conducted on the geography, glaciology, flora and fauna of the area. Accommodation in the form of refuges is available along certain lagoons and ravines in the park, administered by Electro Peru or the Ministry of Agriculture. There is a hostel currently used by mountaineers but eventually planned for the use of scientists.

LOCAL POPULATION The Callejon de Huaylas, just outside the national park is mostly agricultural land and urban development with some grazing, plantation forestry and mining. The national park is uninhabited, although there is some grazing in the lowlands by native livestock (llama and alpaca) under an agreement with the local people.

MODIFICATION OF THE NATURAL ENVIRONMENT The major management issue at present is the proposal to construct a road linking the Callejon de Huayalas in the east and the Callejon de Canchucas. This would detract from the scenic beauty of the area and the improved access could aggravate the existing poaching problem. It was reported in the past that permanent human settlement was not possible because of the severe climate and difficult topography, so the area had only been used periodically for pasturing. However, recent information submitted as a part of the nomination of this area as a world heritage site

suggests that use of the area has been made for some considerable time under an agreement with local people. The affect of this use on the area is not detailed, although it is abused by some illegal grazing of sheep. There is a small mining concession in the park area, agreed before the park's creation, but this is proving increasingly uneconomic. The main changes have been caused by the ravages of fires started both by careless park 'tourists', and in clearing neighbouring land for pasture (ichu forests and 'guenuales' have been extensively damaged), by ice collection from the glaciers, by intensive hunting of the spectacled bear, vicuna, and white-tailed and other deer and, to a lesser extent, careless littering by mountaineering expeditions. Management infrastructure is reportedly insufficient, as the park has only a limited budget.

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Reserva del Manu

BIOGEOGRAPHICAL PROVINCE 8.05.01/8.35.12 (Amazonian/Yungas)

LEGAL PROTECTION Reserve area protected but no legal protection for the Influence Zone. Rational use of timber permitted within Manu National Forest (included in the reserve).

DATE ESTABLISHED 29 May 1973 by Supreme Decree 0644-73-AG. Created a Biosphere Reserve in 1977. Includes Manu National Forest, established by Supreme Resolution 442-1973.

GEOGRAPHICAL LOCATION Lies in the upper Amazon area of Peru, close to Cuzco, the old Inca capital. It includes part of the most eastern mountain range of the Andes and of the lowland region of Amazonia. Located in the provinces of Manu and Paucartambo, in the districts of Madre de Dios and Cuzco. The area is bounded on the north and east by the Divortium Aquarum, separating the catchment basins of the Rivers Piedras and Camisea from the River Manu. It also includes the Manu National Forest, the left bank of the River Alto Madre de Dios and the Atalaya-Tres Cruces highway. 11°19'-13°02'S, 71°07'-72°26'W.

ALTITUDE 240-4,000m

AREA 1,881,200ha (including National Park of 1,532,806ha)

LAND TENURE Both the park and the National Forest are state property. The area between the National Park, the National Forest and the left bank of the River Altro Madre de Dios is state property which can, following negotiation, be made over to the Agrarian Sector (Agrarian Reform etc.). Influence zone is owned by the local community.

PHYSICAL FEATURES Varied relief from high "tablelands" to low forest on flat ground forming the typical abrupt relief of "yungas". Geological background largely belongs to continental sediment. The park consists mainly of the high and low Manu river basin with steep slopes and deep river canyons. The Biosphere Reserve includes the whole of the hydrographic catchment area of the River Manu and part of the catchment area of the River Alto Madre de Dios. Because it covers a wide range of ecosystems, the climatic parameters of the park are varied: mean annual temperature 20°C-24°C in lowland forest, 5°C in higher parts. Rainfall 1500mm-3000mm. High humidity.

VEGETATION Ranging from the alpine grasslands of the Andes to the rainforests of the Amazon, there is probably no other protected area in the world with the diversity of ecosystems and species that compares with Manu over 1,147 species of vascular plants alone were collected in an area of 5 sq.km and it is estimated that other habitats in the park may have five-ten times as many species. It contains nearly all the ecological formations of eastern Peru: humid forest, humid sub-tropical forest, very humid sub-tropical forest, and very humid low mountain forest, with their respective flora and fauna. This area is consequently the most exclusive and representative in the Amazon basin. As the reserve extends over such a wide range its vegetation is extremely varied and much of it has never been classified to a species level or even a generic one. Mahogony, Swietenia sp. and Cedrela sp., and the palm Phytelephas macrocarpa stand out in the very humid wet forests. Other important species include cedar, capirona, cetico, lupuna and quinilla. There are also numerous species of palms, grasses, shrubs and epiphytes. Some botanists claim that Manu has more plant species than any other protected area on earth.

FAUNA There is an incredible diversity of fauna contained in the park - approximately 15% of existing species of bird are found here. Also notable is the occurence of 13 primate species and roughly 110 species of bat and approximately 500,000 species of arthropod. There is an interesting contrast between the species living in the high mountains and those living in the plains. Among the most important are the following: jaguar Panthera onca, white tailed deer Odocoileus virginianus, Peruvians guemal Hippocamelus antisensis, dwarf brocket deer Mazama chunyi, spectacled bear Tremarctos ornatus, (V) giant armadillo Priodontes giganteus, (V) puma Felis concolor and pampas cat F.colocolo (occasionally), ocelot F.pardalis, (V) spectacled caiman Caiman crocodilus crocodilus (V), black caiman Melanosuchus niger (E), Amazon turtle Podocnemis unifilis, giant otter Pteronura brasiliensis, (V) white lipped peccary Tayassu pecari, thirteen species of primates including howler monkey Alouatta sp., capuchin monkey Cebus sp., Emperor tamarin Saguinus imperator (I), red uakari Cacajao calvus (V), squirrel monkey Saimiri sp. and spider monkey Ateles sp.. Boa Boa constrictor and numerous species of snakes include vipers. It is estimated that there are approximately 1000 bird species in the park including: Hoatzin Opisthocomus hoazin, macaw Ara spp., yellow-rumped cacique Cacicus cela , Andean condor Vultur gryphus, and jabiru stork Jabiru mycteria. Andean lapwing Vanellus resplendens, white-winged

cinclodes Cinclodes atacamensis. Flocks of buff-necked ibis Theristicus caudatus and green-winged teal Anas crecca inhabit the small lakes. The Andean flicker Colaptes rupicola is also present. The indigenous fishes are well represented in the rivers.

CULTURAL HERITAGE Up until the 1890s, exploration of river basins of the Manu and Madre de Dios river was largely impossible for outsiders owing to the difficulty of the terrain. However, the area has long been inhabited by tribes of Indians, among them the Machiguengas, the Yaminahuas and the Amahuacas. These tribes have little, if any, contact with the outside world and lead existences which are largely unchanged by modern times. The area is thought to include the legendary Inca city of El Dorado and for this reason there have been several expeditions, some of them clandestine, into the mountains. In 1921, the Dominican father Vicente de Cenitago discovered the complex of petroglyphs of Pusharo, or Pantiacolla, an important archaeological site. These petroglyphs are found on a rock wall more than 30m high and 50m long but owing to their position it has so far been impossible either to date them or to identify their creators. It is likely that the park includes other such notable cultural resources.

ZONING/CONSERVATION MANAGEMENT The area of the reserve containing the National Forest and part of the National Park constitutes the core zone; the buffer zone comprises the area of land traditionally used for agriculture and stock-raising. There is a management plan for the National Park.

STAFF Three professionals, two technicians, 27 park guards

LOCAL ADMINISTRATION Centro de Datos para la Conservacion, Departamento de Manejo Forestal, Universidad Nacional Agraria, La Molina. Apartado Postal 456, Lima, Peru.

VISITOR FACILITIES There are no facilities offered so all visitors must come fully equipped with food and camping gear. Access during the rainy season (October-May) is extremely difficult.

SCIENTIFIC RESEARCH AND FACILITIES Studies conducted at the Coscha Cashu and Panahua Biological Station have been concerned with wildlife including Melanosuchus niger, birds and primates by foreign universities, Pteronura brasiliensis by the National Agronomy University of La Molina as well as the indigenous Machiguenga community living in the park (bio-anthropological studies). Intensifying studies could help evaluate natural resources for the purpose of their adequate management. In addition, the protection of the National Park will allow comparative studies with zones modified by man. Research programme but no monitoring programme. Biological station in Cashu laguna. Guard posts can be used as cabins for bird watching etc. Vehicles for ground/water exploration. Sierra zone is relatively accessible, being only six hours by road from Cuzco. However, the distance to the lower forest zone by outboard motor boat requires 16 hours (two days).

MODIFICATION OF THE NATURAL ENVIRONMENT The Government is considering the construction of a major road along the Manu River through the park. The road is essentially for the promotion, settlement, forestry, agriculture and ranching and will effectively divide the park. Oil and mineral exploration are being conducted and new concessions have been applied for. A canal project would connect two of the watersheds in the park which would affect streamflows and allow boat access. A Dominican Mission has applied for a logging concession and intends to establish a settlement for workers. An American company has recently been granted a gold prospecting concession along

the Palatoa River which, if it proves lucrative, could lead to a gold rush. This would cause enormous problems for the park. Timber encroachment by the local population is another problem as are cattle grazing and fires. Tourism is very light within the core zone.

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Reserva del Noroeste

BIOGEOGRAPHICAL PROVINCE 8.19.04 (Equadorian Dry Forest)

LEGAL PROTECTION Noroeste has the legal status of a National Park. Amotape Hills National Park was established by Supreme Decree 0800-75-AG and is fully protected. El Angolo Hunting Area was established by Supreme Resolution 0164-75-AG, and rational use of fauna is permitted. Tumbes National Forest was established by Supreme Decree 007-8-7-57, and the rational use of timber is allowed.

DATE ESTABLISHED January 1977 as a Biosphere Reserve. Cerros de Amotape was established in 1975, under supreme Decree 0800-75-AG.

GEOGRAPHICAL LOCATION In the departments of Tumbes and Piura on the north coast of Peru, bordering on the frontier of Ecuador and including the massif of the Amotape or Brea hills. 4°53'S, 80°15'W.

ALTITUDE 200-1,613m

AREA 226,300 ha including Amotape Hills National Park (91,300 ha), El Angolo Hunting Preserve (65,000 ha), and Tumbes National Forest (70,000 ha).

LAND TENURE All state property

PHYSICAL FEATURES The Biosphere Reserve embraces the mountain range known as the Amotape or Brea Hills, broken by the river Tumbes. There are also temporary streams, with pools that last throughout the dry period. The average annual temperature is 25°C and average annual rainfall 400mm. There are lithosols on the slopes and sandy soils on the lower hills and plains. In Amotape, the geological profile is primarily marine sediment facies of the Siluro-Devonian age with lithology consisting of slate quartz and shale. In El Angolo, there are no permanent sources of water except for several springs which are at times the only available water supply. The median temperature is 17.5°C and the annual precipitation is between 250 and 500mm.

VEGETATION There are relicts of dry forests in the north-east, with species of silk-cotton tree Ceiba sp., cedars, lion's ear, Cactaceae, Bromeliaceae and Orchidaceae. In Amotape the following species are found: typical of dry forest and thorny wood Prosopis juliflora, Bombax sp. and Caesalpinea corymbosa. In El Angolo among the most common species are Acacia macracantha, Bursera graveolens, Cordia rotundifolia, Ficus genuina, Tillandasia sp. and Fourcroya sp. This area also has the only mangrove swamps in Peru.

FAUNA Typical fauna of the Amazon and the Pacific province are found in the reserve, along with species endangered at the regional and national level. These include jaguar Panthera onca (V), ocelot Felis wiedii (V), howler monkey Alouatta spp., wild cat Felis sp., capybara Hydrochoerus hydrochoeris, Andean condor Vultur gryphus, American crocodile Crocodylus acutus (one of the last remaining populations in Peru), grey deer Odocoileus peruvianus, puma Felis concolor. Doves Zenaidura spp., peregrine falcon Falco peregrinus iguana Iguana iguana and boa Boa constrictor are found in El Angolo.

ZONING/CONSERVATION MANAGEMENT The national park, being fully protected, represents the core zone, with the national rorest and hunting preserve forming the buffer zone. There is no management plan so far. Hunting within El Angolo is largely carried out by local campesinos; there does not appear to be much outside pressure.

STAFF There is a staff of 14 for the protection and management of the reserve.

LOCAL ADMINISTRATION Centro de Datos para la Conservacion, Departamento de Manejo Forestal, Universidad Nacional Agraria, La Molina. Apartado Postal 456, Lima.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES This is the only area in Peru where the flora and fauna of dry forests can be studied. The main topics for research are the ecology and conservation of dry forest fauna, primates of the north-west, reproduction and restocking of the American crocodile, the carob tree plantation ecosystem, the management of species for afforestation of devastated areas, and effects of grazing by goats on dry areas. No formal research or monitoring programme exists. There are no scientific facilities in Amotape.

LOCAL POPULATION There are very few inhabitants within El Angolo and most of these are concentrated near Cabras.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the area remains relatively undisturbed by man. Amotape has been affected by timber felling, hunting and extensive grazing. Internal protection of Amotape is very poor.

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Puerto Galera Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 4.26.13 (Philippines)

LEGAL PROTECTION Declared a tourist zone and marine under Proclamation 1801 in November 1978.

DATE ESTABLISHED 26 January (Presidental Decree No. 354). Approved as a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Comprises the northern tip of Mindura Island and is bounded to the north by the Verde Island Passage, to the west by the Camarong River and to the east by the municipality of San Teodoro. It is not certain whether or not the coral reefs are included within the reserve. 13°23'-13°32'N, 120°50'-121°00'E.

ALTITUDE 0-1,800m (Mt Malasimbo)

AREA 23,545ha (includes Mediok Nature Reserve)

LAND TENURE Mostly government but some parts of the lowlands are privately owned.

PHYSICAL FEATURES The area is generally hilly or mountainous, backed by the Cabarian Ridge and Mt Malasimbo. The coast, which is largely cultivated for coconuts, is 42km long, irregular and indented with numerous coves. The coastline includes muddy flats, coral reefs, mangrove coves, and rocky sandy shores. The almost land-locked Puerto Galera Bay has three extensive coral reefs referred to as the First, Second and Third plateaus, and numerous coves rich with mangrove growth (Gonzales, 1984). The soil is classified as an upland type, formed from hard igneous bedrocks such as basalts, andesite and diorite agglomerates. The climate is relatively dry from November to April and wet during the rest of the year. Typhoons may occur but are generally not severe (Velasquez, 1976). Mean annual rainfall is 2625mm, with an average of 153 days of rain each year (based on three years' of records). Mean annual temperature is 26.9°C, based on records from the nearby station at Calapan. The highest temperature ever recorded in the region is 37.6°C in April 1967. Mean relative humidity in the northern part of Mindoro is 81%, based on 20 years records, with only four months in the year having a relative humidity of less than 80%. Mean wind speed does not exceed 5km/hr on a calm day, but exceeds 100km/hr in the typhoon season (July-October).

VEGETATION Comprises 5,248ha of forest, including the Malasimbo rainforest, 3,179ha of brushland, 100ha of mossy forest, and 5,748ha of cultivated land.

FAUNA A wide variety of endemic species are present, including tamaraw Bubulus mindorensis (E), Mindoro imperial pigeon Ducula mindorensis, Mindoro flowerpecker Dicaeum retrocinctum, some fish and the terrestrial mollusc Chrysallis mindorensis (Wells, 1982).

CULTURAL HERITAGE The area is home to the Iraya Mangyans, native people who continue to practise a traditional way of life (Berdach, 1979).

ZONING/CONSERVATION MANAGEMENT The middle of the reserve comprises a core area of unmodified natural upland forest under Proclamation 1801, tourism is given priority over conservation. In July 1981 the Bureau for Fisheries and Aquatic Resources directed the local authority in Puerto Galero to limit and control the exploitation of the coastal area by beach resort operators and

coastal residents (Wells, 1982). The Philippine Tourist Authority, having given some control and administrative powers over tourist activities, is expected to co-ordinate the integrated development of the area for the optimum use of natural resources and existing facilities. This would include delineating areas with potential value for tourism (IUCN, in prep.).

STAFF No information

LOCAL ADMINISTRATION No information

VISITOR FACILITIES Puerto Galera has become one of the most important tourist resorts in the Philippines since the early 1970s. The number of visitors has increased from an average of 590 per month in 1980 to 1,000 per month in 1982, excluding local tourists (Gonzales, 1984). Cottages have been constructed on beaches which were once of prime importance for research. A marina is being planned and the harbour area is being rapidly developed with shops, restaurants and hotels (Wells, 1982), despite recommendations to develop a neighbouring village where such development would have less impact on the coral reefs. The National Museum has been given the responsibility of establishing an interpretative centre in the form of an 'outdoor museum' in the town of Puerto Galero (Gerdach, 1979).

SCIENTIFIC RESEARCH AND FACILITIES A biological research station has been maintained in the area by the University of the Philippines since its foundation in 1933. Puerto Galero is an important research site, largely due to its diversity and accessibility. The area has also been used by several universities and colleges for summer field courses. Research involves mostly inventory of resources and environmental monitoring (Gonzalez, 1984). Following a study of the rational development of Puerto Galera by the University of the Philippines in 1975, it was concluded that the area's natural resources are inadequate for the present human population.

LOCAL POPULATION Almost half of the 1,682 householders in the area have become involved in the tourist industry either directly or indirectly (Gonzalez, 1984).

MODIFICATION OF THE NATURAL ENVIRONMENT Considerable changes have taken place since the 1930s, when there was no regular ferry service, the area was heavily forested, the beaches uninhabited, and there were only 27 houses in the town. By the 1950s the area behind the town was denued by trees and illegal fishing was depleting the marine resources. Between 1960 and 1970 the population almost doubled and is currently about 1,300. Logging and marble mining are causing pollution and siltation, sand is removed from the beaches for glass factories in Manila and oil effluents reach the beaches from the refinery in Batangas. Coral has been used as a filling material in place of sand and gravel to protect the beaches from erosion, and at one time corals were being collected for the ornament trade (Wells, 1982).

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Babia Gora National Park

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED The area has been under protection as a nature reserve since 1934. The national park was created under the Resolution of the Council of Ministers of 30 October 1954 and approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION The national park is located in two administrative districts (Bielsko and Nowy Sacz) in south central Poland on the Czechoslovakian border and is part of the Higher Beskid mountain range. It lies some 54km south-west of Krakow and 36km south-east of Brelsko-Biata. The south slopes of Babia Gora lying in Czechoslovakia are also under protection. 49°34'N, 19°32'E.

ALTITUDE 850-1,725m

AREA 1,741ha

LAND TENURE 1,606ha is in state ownership, the remainder is private and cooperative.

PHYSICAL FEATURES The Babia Gora National Park is situated in the west part of the Carpathian mountain arc, in the Beskid Wysoki chain and occupies the highest part of the western Beskids. It covers the mountain massif of Babia Gora with peaks at Diablak (1,725m), Glownicak (1,617m), Kepa (1,521m), Cyl (1,517m) and Sokolica (1,367m). The park area is separated from the adjacent massifs in the west by the Jalowiecka Pass (1017m) and in the east by the Krowiarki Pass (986m). Sandstones and dusty slates form the rocky subsoil. The core of the Babia Gora massif is formed by the layers of the so-called Magurski sandstone; hieroglyphic layers and marls appear in lower sites. Above the timber line there are wide areas overstrewn with gigantic rocks, which is characteristic of the area. Average annual temperature at the altitude between the upper and lower forest belts (1,150m) is about 4°C and at the upper timberline (1,390m) is about 2.5°C. Average annual precipitation varies from 1068mm to 1226mm, depending on elevation and exposure.

VEGETATION The vegetation occurs in the successional zones: the lower forest zone, from the base of the massif up to 1,150m; the upper forest zone, at 1,150-1,390m; the mountain pine zone, at 1,390-1,650m; the alpine zone, at 1,650-1,725m. The forests have a characteristic structure with primaeval Carpathian forest especially in the upper parts of the lower mountain forests. In the lower forest zone associations of Fagetum carpaticum and Abieto-Piceetum montanum, scarce Alnetum incanae and very rare Betulo-Adenostyletea occur. The predominant forest cover is beech Fagus sylvalica over a ground flora of Allium ursinum and Festuca silvalica. In the upper forest zone: Piceetum excelsae carpaticum with fir-spruce and mixed with beech. When passing from lower to upper forest zone Sorbo-Aceretum carpaticum associations are found. At the upper limit of the forest zone, Mughetum carpaticum, Betulo-Adenostyletea, Vaccinium myrtilli and Empetro-Vaccinietum occur with fir forest over a ground storey of Lycopodium annotinum and Luzula flavescens. In the alpine zone the associations are Deschampsio-Luzuletum and Trifido-Supinetum. The flora of Babia Gora, includes 700 higher plant species, about 200 species of mosses, 100 species of liverworts, some 100 species of lichens and 118 species of algae. The rarest plants are Laserpitium archangelica and Cerastium alpinum, which do not appear elsewhere in Poland.

FAUNA Mammals include brown bear Ursus arctos, lynx Lynx lynx, red deer Cervus elaphus, roe deer Capreolus capreolus, wild boar Sus scrofa and otter Lutra lutra. Birds include buzzard Buteo buteo, eagle owl Bubo bubo, hobby Falco subuteo, long-eared owl Asio otus, capercaillie Tetrao urogallus, hazel hen Tetrastes bonasia, ring ouzel Turdus torquatus, three-toed woodpecker Picoides tridactylus and dipper Cinclus cinclus.

ZONING/CONSERVATION MANAGEMENT There is a strict protection policy on 1,061ha of the park area which the remainder under a partial protection regime. A buffer zone is planned, and the site lies in an area planned as a protected landscape. Strict protection policy on part of the park with the remainder under partial protection.

STAFF From a total of 16 personnel, six wardens are assigned to protection duties and one person is assigned to scientific research.

LOCAL ADMINISTRATION Babia Gora National Park Siedziba Dyrekeji i muzeum, 34-223 Zawoja, Poland.

VISITOR FACILITIES Tourism is strictly controlled and sightseeing in the park area is only permitted along the marked hiking tracks. No motor vehicles are allowed.

SCIENTIFIC RESEARCH AND FACILITIES Scientific research began in the area of the present national park as early as the 19th century, with studies of geological structure, vegetation and fauna (Kotula, Sila-Nowicki, Stobiecki). Research on geomorphology (Sawicki, Kiimaszewski), on the fauna (Kulczynski) and on the vegetation (Walas) of the area as well as climatological and hydrobiological studies have contributed to the existing knowledge on Babia Gora. After the national park was established, a detailed phytosociological inventory (Celinski, Wojterski) and soil inventory (Adamczyk, Baran) provided the basis for elaboration of the forest spatial management plan. A general management plan for the national park was also prepared. Future research should examine the dynamics of development of the plant communities and the conditions for regeneration of particular tree species. Special notice should be given to recognition of ecotypes of indigenous tree species and to their role in genetic preservation. Research should explore the influence of wildlife upon the plant associations. To date 20 publications have reported research specifically conducted in the biosphere reserve, with 16 dealing with botanical subjects (including pollution problems), three with zoological topics and four with tourism and carrying capacity studies. There is active cooperation between the Polish MAB and Bulgarian MAB reseachers with annual exchanges of personnel. Bulgarian researchers have worked in Babia Gora for several seasons in the 1980s. A natural history museum is located near the national park boundary.

MODIFICATION OF THE NATURAL ENVIRONMENT Portions of the forest were managed intensively before the national park was created with the result that parts have been greatly modified, especially on the south slope. In contrast, the forests of the north slope of the Babia Gora massif show scarcely any trace of human management and have an apparently natural species composition.

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Bialowieza National Park

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Boreonemoral)

LEGAL PROTECTION Total

DATE ESTABLISHED Designated as a National Park in October 1947, but protected as a nature reserve since 1921. It was approved as a Biosphere Reserve in June 1976, and accepted as a World Heritage site in 1979.

GEOGRAPHICAL LOCATION North east-central Poland on the border with Byelorussian SSR in Bialostockie administrative region, 62km south-east of Bralystok and 190km north-east of Warsaw. 52°44'N, 23°51'E.

ALTITUDE 170-202m

AREA 5,316ha

LAND TENURE State ownership

PHYSICAL FEATURES Situated on the hydrological divide between the Baltic and Black Seas, the area is covered by the central Poland glacial formation with deposits composed of deep sands and sands overlying clays (40%) and clays and loams overlying the Cretaceous bedrock (35%). Other major deposits are organogenic formations of peat and marshy peat occurring in river valleys and local depressions which often contain raised mire systems. The park is enclosed by the rivers Narewka (to the south) and Hwozna (to the north). It has a subcontinental climate, with an annual rainfall of 624mm and a mean annual temperature of 6.6°C. Average temperature in January -4.3°C, in July 17.6°C.

VEGETATION The national park is situated in the central part of an extensive forest complex (1,250 sq.km) and includes forest associations which show characteristics of primaeval forest, and is thus a unique fragment of the lowland natural forest in this part of Europe. Forest cover 4,904ha are strictly protected. There are over 700 species of vascular plant constituting about 32% of the species found in Poland. All the major forest associations of this part of Europe occur including, pine, mixed fir-pine with oak, marshes with pine and fir, hornbeam, ash and alder and pure alder. There is a complete lack of beech, yew and holly, with lime, oak and hornbeam accounting for 44% of forest cover; spruce-pine-birch mixture covers an additional 20% with ash and alder amounting to 12%. These forest associations contain 26 tree species, include Picea excelsa, Pinus silvestris, Carpinus betulus, Tilia cordata, Alnus glutinosa, Quercus robur, and Fraxinus excelsior, 55 shrubs occur. Brushwood associations on the peat soils are composed mainly of Salix cinerea, Betula humilis and Pinus silvestris, and meadow associations and aquatic communities also occur. Rare plant species include Linnaea borealis, Pedicularis sceptrum - carolinum, Isopyrum thalictroides, Lathyrus laevigatus and Hedera helix (here at its eastern range).

FAUNA There are 56 species of mammal including two packs of wolves Canis lupus and 30 lynx Felis lynx, otter Lutra lutra, northern birch mouse Sicista letulina and masked shrew Sorex caecutiens. There are some 228 species of birds 162 of which breed, including capercaillie Tetrao urogallus, black stork Ciconia nigra, most of the European owls including pygmy Glaucidium passerinum, Tengmalm's Aegolius funereus and eagle owl Bubo bubo a large number of raptors such as spotted eagle Aquila clanga and booted eagle Hieraeetus pennatus, three-toed woodpecker Picoides tridactylus, redwing

Turdus iliacus and nutcracker Nucifraga caryocatactes. The park is the site of a successful re-establishment of the European bison Bison bonasus (exterminated in the Bialowieza Forest in 1921). Reintroduction was initiated in 1929 in a fenced reserve which forms part of the park. This effort was subsequently extended by reintroducing bison from the reserve into the areas of the forest outside the fenced area. At present 250 bison range freely. The beaver Castor fiber has also been reintroduced successfully. The endangered European butterfly, the false ringlet Coenonympha oedippus has been recorded in the forest.

ZONING/CONSERVATION MANAGEMENT Core zone 4,747ha. The buffer zone (10-20km wide) on the north and west comprising state forests. Zone of 272ha for restoration of bison Bison bonasus and wild horses of forest tarpan type Equus caballus gmelini. Landscaped zone of 50ha around the Park management site. The east boundary of the park forms the frontier with the USSR, where an adjacent forest area (the Belovezhskaya Pushcha Hunting Reserve, covering 87,577ha and created in 1940) is under protection. To the south, agricultural lands are to be reforested to provide a buffer zone.

STAFF Seventy employees, five supervising the strict reserve (one ranger and four guards). A major activity involves management of the bison with a head and a staff of four at the restoration centre, and a further ten involved in management of the free-ranging bison. A research scientist carries out studies related to park management, including the management of bison.

LOCAL ADMINISTRATION Bialowieski Park Narodowy, 17-230 Bialowieza, 0124400 Poland. Central administration is by the Ministry of Forestry and Timber Industries.

VISITOR FACILITIES About 100,000 visitors annually with access limited to marked tracks. Trained guides are assigned to individual groups of tourists and youth excursions with the agreement of the National Park management, and are provided by the Polish Tourist Country Lovers Association. Guided trips are allowed to use traditional horse drawn vehicles.

SCIENTIFIC RESEARCH AND FACILITIES Bialowieza National Park has been used for scientific research since the 1920s, when Professor Paczoski, a prominent botanist and phytosociologist, was appointed as the first manager of the park. Results of his research are included in the Forests of Bialowieza (1930). Zoological studies especially on wood-boring insects were begun in 1929 by Karpinski, Professor Paczoski's successor, and then extended by Professor Dehnel. The park staff is currently carrying out work on the phenology of plants and animals, physiology and ecology of bison, and entomology. Seventeen scientific institutions of Warsaw university are carrying out research in the park. Up to 1978, 31 publications have reported research specifically conducted in the biosphere reserve; 16 dealing with botanical subjects, nine with zoological research and six with a variety of other topics. The park facilitates studies on structure and functioning of natural ecosystems, natural succession, and the flow of substances and energy within ecosystems (as well as observing impacts on these processes resulting from human modification of ecosystems), the circulation of parasites in natural and modified ecosystems, classification of animals (especially of lower systematic units), forest management, biological control of pest insects, genetically valuable ecotypes of indigenous tree species, and on improving the optimization of forest productivity. There are three permanent field stations: the Nature Protection Laboratory of the Forest Research Institute field station, established in 1945, managed by the Section of Forest Ecology; the Mammal Research Institute of the Polish Academy of Sciences,

established in 1954, and the Bialowieza Geobotanical Station of Warsaw University established in 1962. The Museum of Nature and Forestry is managed by a custodian, who conducts scientific and educational activities in The Park.

MODIFICATION OF THE NATURAL ENVIRONMENT No human settlements or tourist facilities are located within the strictly protected core area of the park. The administrative site is located at the park boundary.

PRINCIPAL REFERENCE MATERIAL

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Lukajno Lake Reserve

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Boreonemoral)

LEGAL PROTECTION Established as a reserve in 1947 to protect the habitat of mute swan Cygnus olor and other waterfowl. The area protected includes the entire lake with a 300m wide strip of the surrounding shore.

DATE ESTABLISHED Reserve created in 1947 and approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION In the Mazurian Lake District of north-east Poland in the Suwalski Administrative Region 2.5km east of the town of Mikolajki and 78km east of Olsztyn just to the north of Lake Sniardwy. 53°49'N, 21°38'E.

ALTITUDE Mean lake level at 115m, with fluctuations between 115.7m and 117m

AREA 710ha

LAND TENURE State ownership. Managed by state forest district board at Olsztyn.

PHYSICAL FEATURES The Lukajno Lake is of glacial origin, having a flat-bottomed basin measuring 3,300m north to south and 2,900m east to west. The average depth is 0.6m, with a maximum depth of about 3m. The lake is fed by numerous drainage channels from the surrounding marshy areas and water flows out from the lake through a channel to the Sniardwy Lake.
Average annual air temperature is 6.5°C. Mean annual precipitation is 550-600mm.

VEGETATION The sites is composed of 585ha of open water, 101ha of swamp vegetation, 15ha of forest and 9ha of meadows and grasslands. 166 species of vascular plants occur in the reserve, rare species including Callitriche verna, Daphne mezereum, Salix nigiricans, Sparangium minimum, Stellaria palustris, Triglochin palustre. The most important plant communities include: Charetum acuteolatae (occupying nearly two-thirds of the bottom area of the lake); C. contrariae (on a quarter of the bottom) and C. asperae, C. tomentosae which provide the main food supply for the mute swans Cygnus olor.

FAUNA The reserve is the largest natural colony of mute swans Cygnus olor in Europe numbering about 2,000 birds in 1968. After several years of decrease, an increase in the population of swans is now evident. In addition 171 other bird species occur in the reserve, including the rare red-crested pochard Netta rufina, black-necked grebe Podiceps nigricollis, bewick swan Cygnus columbianus bewickii, caspian tern Sterna caspia (on passage) and bearded tit Panurus biarmicus. Birds of prey are numerous with white-tailed eagle Haliaetus albicilla, golden eagle Aquila chrysaetos, lesser-spotted eagle A. pomarina, osprey Pandion haliaetus and black kite Milvus migrans breeding in the surrounding forests. The lake is also a natural spawning ground for many fishes.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone consisting of a strip of land 300m wide surrounding the lake. The site lies within the Mazurski Landscape Park (category V) (49,616ha) created in 1977. The 300m strip of land surrounding the lake constitutes a buffer zone. Access to the reserve is controlled (there is not tourist accommodation in the reserve) in order to limit levels of disturbance and hunting is prohibited. Fishing is allowed after the swams have departed on autumn migration.

STAFF Supervision of protection and management of the reserve is carried out by the regional conservator for nature in the district office at Suwalki. The reserve area is guarded by a warden and by forest personnel.

LOCAL ADMINISTRATION Nadlesnictwo Strzalowo, Superintendent Forestry Strzalowo, 11-733 Baranowo.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Major topics under investigation include: influence of agricultural runoff on the eutrophication and pesticide levels in the lake and residue impacts on biota; alleviation of pollution in the lake; impact of Cygnus olor on aquatic vegetation; and the population dynamics of Cygnus olor.

MODIFICATION OF THE NATURAL ENVIRONMENT Lukajno Lake is considered to be largely unmodified by man, although much of the surrounding watershed is used for agriculture.

PRINCIPAL REFERENCE MATERIAL

Bibliography of 35 entries is on file with MAB Secretariat, Unesco, Paris.
Gawlowska, J. (1978). Wykaz prac naukowych prowadzonych aktualnie w polshich rezerwatach biosfery Chronmy Prayrode Ojczysta R. 34 z. 3. Pp. 74-85.

Slowinski National Park

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED The national park was created by Resolution of the Council of Ministers on January 1967 and approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION Occupies a 32km stretch of the Baltic coast in the Slupsk Administrative Region, 18km north-east of Slupsk and 71km north-west of Gdansk. 54°39'-54°43'N, 17°03'-17°31'E.

ALTITUDE 0-55m

AREA 18,069ha. The national park area has been increased to 18,247ha.

LAND TENURE The majority (17,694ha) is in state ownership.

PHYSICAL FEATURES The national park consists of two large lakes (Lake Lebsko and Lake Gardno) separated from the low sandy sea coast by forested sand dune spits. The lakes show a variable salt content and are becoming shallower as deposits brought in by the two main feeder rivers (Leba and Lupawa) build up. The area has ecosystems representative of those found along the south shore of the Baltic Sea, classified into: 1) dunes at various stages of formation; 2) mobile dunes, the highest in Europe (up to 45m), drifting yearly at a rate of 5m per year; 3) depressions between the dunes with characteristic soil formations (gley soils); 4) forested spits separating the coastal lakes from the sea; 5) fossil soils; 6) salt ladened lakes (Leba and Gardno) which are undergoing intermittent salinization; 7) ephemeral lakes in depressions between dunes; 8) coastal peat bogs. The ongoing process of dune formation is encroaching on the forested areas and infilling the lakes.

VEGETATION The park area includes 4,532ha of forest and 9,771ha of water areas. The plant communities are zoned from the coast inland starting with a beach community Honckenya peploides, Cakile maritima; pioneer grasses on white sand dunes Elymo-Ammophiletum; and a coastal pine community Empetro nigri-Pinetum, which shows much variety including stands of birch Betuletum pubescentis; pine with a dense bog myrtle understory Vaccinio uliginosa-Pinetum; "atlantic" raised bogs with bog myrtle Myrica gale

marshy-heath with Erica tetralix; and pioneer communities in the depressions between dunes. The lake shores of exhibit plant community sequences grading from aquatic with Potamogeton lucentis, Myriophylletum laterniflori to alder woods Alnus glutinosa and to mixed forest of pine-beech and pine-oak. The peatbogs are characterised by the presence of species such as Drosera rotundifolia, D. intermedia, D. anglica and Lycopodium inundatum.

FAUNA The bird fauna comprises about 250 species of nesting, migrating and wintering birds. Breeding species include: white-tailed eagle Haliaeetus albicilla, osprey Pandion haliaetus, eagle owl Bubo bubo, short eared owl Asio flammeus, mute swan Cygnus olor, raven Corvus corax, herring gull Larus argentatus, black stork Ciconia nigra and crane Grus grus. A large population of red deer Cervus elaphus inhabits the coastal forest along with roe deer Capreolus capreolus, wild boar Sus scrofa, polecat Mustela putorius, and pine marten Martes martes. The relatively clean water favours the occurrence of salmonid fish whilst the lakes hold both freshwater and salt water species.

CULTURAL HERITAGE The village of Kluki (and Smoldzino, which is just outside the park boundary) are of ethnographic interest and the area is known for its ethnic Kaszubian minority the Slowincy.

ZONING/CONSERVATION MANAGEMENT The national park covers 18,247ha whilst the biosphere reserve covers 18,069ha and includes 5,935ha under strict protection of which 3,264ha are forests. There are two strict reserves on Lake Lebsko and two (one being a small island) on Lake Gardno with a forest-sand dune reserve along almost the entire coastal section. Particular protection is given to dunes on spits; bird nesting areas on the lakes and lakeshores; soil formations on the dunes; stands of cloud berry Rubus chamaemorus; and forests on peat soils. The remainder of the national park is under partial protection. Economic exploitation and human interference is prohibited in the strict protection areas but traditional practices are maintained in the partially protected areas. Dune stabilization has been attempted in the past. Vehicular traffic has been eliminated in favour of hiking which has tended to limit damage to the site.

STAFF Fourteen field guards for protection; two research workers

LOCAL ADMINISTRATION Slowinsky Park Narodowy, 76-124 Smoldzino, Poland.

VISITOR FACILITIES Within the national park, visitors are restricted to hiking tracks. Tourist accommodation is located outside the national park boundaries.

SCIENTIFIC RESEARCH AND FACILITIES To date 24 publications have reported research conducted solely in the biosphere reserve, ten reports on botanical subjects, nine on zoological and five on miscellaneous subjects. The research work covers the subjects of soils, geomorphology, palaeobotany, geobotany and ornithology. Mapping of soils and plant communities have been carried out most recently and research projects on palaeobotany, geomorphology, soils and ecology are also continued. A natural history museum is located near the park.

LOCAL POPULATION Within the national park there are seven settlements including the villages of Gac and Kluki, but the area is sparsely inhabited and is remote from large towns.

MODIFICATION OF THE NATURAL ENVIRONMENT No significant modifications in the ecosystems have occurred within Slowinski National park. and the small settlements present exert a minimal influence upon the environment. Before

establishment of the national park, there was little forest exploitation in the area this being limited to gathering berries and mushrooms, and the use of peat as a fuel. Agriculture was neither extensive nor intensive. The influx of tourists has increased greatly since the park was established with the greatest activity along the hiking tracks.

PRINCIPAL REFERENCE MATERIAL

Bibliography of over 130 references is on file with MAB Secretariat, Unesco, Paris.

Gawlowska, J. (1978). Wykaz prac naukowych prowadzonych aktualnie w polshich rezerwatach biosfery Chronmy Przyrode Ojczysta R. 34 z. 3. Pp. 74-85.

Paul do Boquilobo Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED It was created a Hunting Reserve in 1977 under Law 35-A/created a Nature Reserve in 1980 and accepted as Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION Central Portugal, about 60km inland, just south of Entroncamento on the Almonda River. 39°24'N, 9°28'W.

ALTITUDE 14-16m

AREA 395ha

LAND TENURE Private

PHYSICAL FEATURES The reserve includes a freshwater lake surrounded by marsh which lies in a bend of the river Almonda. This is a tributary of the Tejo, which it joins 4km to the south; the reserve is situated on the Tejo floodplain and is regularly inundated in summer. The climate is influenced by the Atlantic and wetter than the true Mediterranean areas further south.

VEGETATION There is typical marsh vegetation around the lake with reedbeds and on firmer ground grow willows Salix spp. and poplars Populus spp..

FAUNA This is the most important heronry in Portugal and second most important in Western Europe, with up to 850 breeding pairs of six species: little egret Egretta garzetta, cattle egret Bubulcus ibis, purple heron Ardea purpurea, squacco heron A. ralloides, black-crowned night heron Nycticorax nycticorax and little bittern Ixobrychus minutus. It is also the most important wintering place for ducks in Portugal, with about 2,500 of seven species: mallard Anas platyrhynchos, shoveller A. clypeata, wigeon A. penelope, green-ringed teal A. crecca, pintail A. acuta, pochard Aythya ferina and tufted duck A. fuligula. It is a particularly important staging post for migrant passerines, which may number 5,000-10,000 during the autumn passage.

ZONING Three core areas of two, five and ten hectares will be designated including the densest willow growths. Around those are buffer zones where the water level will be reduced in summer to allow controlled cultivation. There is an integral reserve covering 120ha.

STAFF No information

LOCAL ADMINISTRATION No information

VISITOR FACILITIES Access is unrestricted and the reserve is near a main road and railway line.

SCIENTIFIC RESEARCH AND FACILITIES Being one of the few freshwater marshes in this climatic zone makes Paul do Boquilobo a unique site for studying the dynamics of this ecosystem. With its major ornithological importance, especially for breeding herons, wintering waterfowl, and the major passage of migrants through the area, it is an ideal site for developing an international cooperative programme of research and education.

LOCAL POPULATION The local population is mainly involved in agriculture, including intensive cultivation. The town of Torres Nova is nearby.

MODIFICATION OF THE NATURAL ENVIRONMENT The area of natural marsh has been much decreased by encroaching agriculture over the centuries since the first attempt at drainage in 1350. Invasion by Eichornia crassipes has begun. Intensification of agriculture in the 1970's caused the cutting down of willows, removal of reeds and ploughing up of marshland for maize, sunflowers, beans and tomatoes. Digging dykes and pumping out of water has further reduced the area so that in most summers only small areas of permanent water remain. The number of herons breeding was probably over twice as many in the past.

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Pietrosul Mare Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established as Nature Reserve in 1971 and accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION The reserve is located in the Rodna massif in the northern section of the eastern Carpathians in the administrative district of Maramures. 47°40'N, 25°00'E.

ALTITUDE 900-2,303m

AREA 3,068ha

LAND TENURE Government

PHYSICAL FEATURES This is a mountainous area, with Peitrosu Mare being the highest peak and several others reaching over 2,000m. The area was glaciated during the Quaternary with glaciers extending down to 1,250m. Many features produced by ice erosion are present, including cirques, deep, steep-sided valleys, arêtes and glacial lakes.

VEGETATION The flora is extremely varied due to the range of altitudes and includes beech Fagus sp. on lower slopes and spruce Picea sp. at higher altitudes, with arolla pine Pinus cembra at the treeline. Above this are shrubby species of mountain pine P. mugo and green alder Alnus viridis. There are also alpine meadows and large areas of Rhododendron kotschyi. There are a large number of species with a disjoint arcto-alpine distribution: Cerastium alpinum, Silene acaulis, Atragene alpina, Ranunculus glacialis, Arabis alpina, Rhodiola rosea, Saxifraga paniculata, S. adescendens, S. androsacea, S. aizoides, S. stellaris, S. hieraciifolia, Astragulus penduliflorus, Epilobium alsinifolium, Veronica fruticans, Euphrasia salisburgensis, Bartsia alpina, Pedicularis oederi, P. verticillata, Gentiana nivalis, Gnaphalium supinum, Hieracium aurantiacum, Saussurea alpina, Luzula alpino-pilosa, Eriophorum scheuchzeri, Carex fuliginosa, Poa alpina and P. laxa. A number of plants have a widespread circumpolar distribution: Woodsia ilvensis, Diphasus alpinum, Salix herbacea, S. reticulata, S. jacquini, Polygonum viviparum, Oxyria digyna, Sagina saginoides, Anempne narcissiflora, Saxifraga oppositifolia, Dras octopetala, Hedysarum hedysaroides, Epilobium alpinum, Loiseleuria procumbens, Veronica alpina, Lloydia serotina, Alloum victorialis, Juncus trifidus, J. triglumis, J. castaneus. There are also a large number of orophytes with an extensive circumpolar distribution: Lycopodium annotinum, Selaginella selaginoides, Polystichum lonchitis, Parnassia palustris, Geum rivale, Viola biflora, Circaea alpina, Monoeses uniflora, Vaccinium vitis-idaea, V. myrtillus, Menyanthes trifoliata, Antennaria dioica, Eriophorum vaginatum, Allium sibiricum, Coeloglossum viride, Listera cordata, Goodyera repens. However, the dominant element is the plants with central European alpine affinities, which are characteristic of the Rodna Massif: Pinus mugo, Salix retusa, Alnus viridis, Rumex alpinus, Callianthemum coriandrifolium, Pulsatilla alba, Ranunculus oreophilus, R. thora, R. alpestris, Cardaminopsis halleri, Draba carinthiaca, Helianthemum oelandicum subsp. alpestre, Viola alpina, Sempervivum montanum, Saxifraga bryoides, Ribes petraeum, Potentilla aurea, P. thuringiaca, Geum montanum, G. reptans, Trifolium badium, Epilobium alpestre, Polygala alpestris, Burpleurum ranunculoides, Ligusticum mutellina, Soldanella major, Androsace

obtusifolia, Primula minima, P. halleri, Veronica aphylla, V. bellidioides, Tozzia alpina, Calamintha alpina subsp. baumgarteni, Gentiana punctata, G. clusii, G. excisa, G. frigida, G. orbicularis, Galium anisophyllum, Valeriana montana, Scabiosa lucida, Campanula alpina, Erigeron neglectus, Achillea sudetica, Adenostyles alliariae var. kerneri, homogyne alpina, Hypochoeris uniflora, Leontodon croceus, Carex curvula, Poa media, Helictotrichon veriscolor, Festuca pumila, F. violacea). Although not common, there are Balkan elements in the flora represented by Carpathian-Balkan species: Potentilla ternata, Linum extraaxillare, Hypericum alpigenum, Telekia speciosa, Saxifraga carpathica, Erysimum wittmanii, Senecio papposus, Doronicum carpaticum, Ligularium carpatica, Centaurea moillis, Sesleria caerulans, Crocus heuffelianus. One can also distinguish some species with Alpine-Carpathian-Balkan distributions: Silene italica subsp. nemoralis, Aconitum paniculatum, Anthemis carpatica, Achillea tanacetifolia subsp. stricta, Artemisia petrosa, Senecio subalpinus, Cirsium waldsteinii, Crepis jacquinii, Scorzonera rosea, Festuca picta. Silene nutans, Dianthus compactus, Dianthus tenuifolius, Aconitum moldavicum, Ranunculus crenatus, papaver corona-sancti stephani, Cardamine glandulifera, C. opizii, Sempervivum marmoreum, Jovibarba heuffelii, Saxifraga luteoviridis, Saxifraga pedemontana subsp. cymosa, S. heucherifolia, Oxytropis carpatica, Onobrychis transsilvanica, Heracleum transsilvanicum, Viola declinata, V. dacica, Bupleurum diversifolium, Rhododendron kotschyi, Primula leucophylla, Gentiana phlogifolia, Pulmonaria rubra subsp. filarszkiana, Symphytum cordatum, Thymus pulcherrimus, Veronicus baumgarteni, Swertia punctata, Campanula abietina, C. kladniana, C. polymorpha, C. napuligera, C. carpatica, Symphyandra wammeri, Phyteuma wagneri, P. nanum, Anthemis macrantha, Achillea lingulata, Centaurea kotschyana, Achillea schurii, Chrysanthemum rotundifolium, Senecio glaberrimus, Carduus kerneri, Alopecurus laguriformis, Poa media, Festuca porcii). Some species are endemic to the region, including: Polyschemone nivalis, Heracleum carpaticum, Melampyrum saxosum and Saussurea porcii.

FAUNA The fauna is diverse, mainly composed of alpine or boreal species, like snow vole Microtus nivali, horned lark Eremophila alpestris, Tengmalm's owl Aegolius funereus, dotterel Eudromias morinellus and capercaillie Tetrao urogallus. There are also several pairs of golden eagle Aquila chrysaetos and imperial eagle A. heliaca. Large mammals include wild boar Sus scrofa, wild cat Felis silvestris, lynx Lynx lynx and roe deer Capreolus capreolus. Recently, alpine marmot Marmota marmota have been introduced and there have been several attempts at naturalising chamois Rupicapra rupicapra from Retezat National Park.

ZONING/CONSERVATION MANAGEMENT There is a core area of 750ha. The vegetation is fairly undisturbed, and strict protection since 1971 has helped regeneration of the dwarf pine Pinus mugo at the treeline which had suffered from grazing. In the buffer zone, seasonal grazing is allowed, but other activities prohibited. There are plans to include the reserve as the core of a much larger Rodna Mountains national park.

STAFF Staff from the Borsa Forest District supervise the reserve.

LOCAL ADMINISTRATION Academia Republicii Socialiste Romania, MAB National Committe of Romania, 71102 Calea Voctoriei nr. 125, Bucaresti, Romania.

VISITOR FACILITIES The core is strictly protected. Access is from the Komplexul Turistic Borsa on the Baia Mare-Cîmpulung road.

SCIENTIFIC RESEARCH AND FACILITIES Work has been done in the Rodna mountains on geology, fauna and flora. Recent research includes peat bog pollen analysis, cytotaxonomy and productivity studies of the beech forests and alpine pastures.

LOCAL POPULATION Some people live at lower altitudes in the surrounding areas and summer grazing is permitted in the buffer zone.

MODIFICATION OF THE NATURAL ENVIRONMENT In the past the Pinus mugo at the treeline has been reduced by grazing but this is recovering with increased protection. Summer grazing occurs in the buffer zone.

PRINCIPAL REFERENCE MATERIAL

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Retezat National Park

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED It was established as a National Park in 1930 and accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION The park is situated in southern Carpathian mountains in the administrative district of Hunedoara; 45°25'N, 22°45'E.

ALTITUDE 890-2,509m

AREA 20,000ha

LAND TENURE Government

PHYSICAL FEATURES The park is in a high mountainous area, with 20 summits over 2,300m, the highest being the peak of Peleaga. The Retezat massif is a well-defined block of upland, separated on most sides from the rest of the range by deep valleys and to the north overlooking the Tertiary Hateg basin. This area was glaciated in the Quaternary and has many landforms caused by glacial erosion, including cirques, some with lakes, deep steep-sided valleys and arêtes. Temperatures decrease markedly with altitude.

VEGETATION The vegetation is extremely diverse due to the varied relief and the position of the Retezat massif, at the junction of three floristic regions. About 1,180 vascular plants have been recorded. There is marked zonation dependant on altitude, with sessile oak Quercus petraea, hornbeam Carpinus betulus and walnut Juglans reglia, the latter introduced. There are large areas higher up of beech Fagus sp. mixed with fir Abies sp. and Norway spruce Picea abies. At the treeline about 1,870m, there are extensive areas of mountain pines Pinus mugo and arolla pine P. cembra. A zone of dwarf sub-alpine vegetation occurs between 1,550m and 2,190m with low-growing pines. Above this, alpine vegetation occurs, with species of Potentilla, Festuca, Vaccinium, Rhododendron and Primula. These mountains seem to be a centre of endemicity for the genus Hieracum of which there are 34 endemic species in a limited area. They include H. bucuranum, H. nigrilacus, H. pelagae, H. roimarense and H. zanogae. The alpine and sub-alpine flora contains species with a circumpolar-alpine distribution Salix herbacea, Oxyria digyna, Anemone narcissiflora, Saxifraga oppositifolia, Dryas octopetala, Loiseleuria procumbens, Juncus trifidus. Some species demonstrate the separation that has occurred between various arcto-alpine plants: Lycopodium alpinum, Cerastium alpinum, Silene acaulis, Atragene alpina, Rhodiola rosea, Saxifraga aizoides, S. stellaris, S. androsacea, Epilobium alsinifolium, Gentiana nivalis, Bartsia alpina, Pedicularis verticillata, Hieracium aurantiacum, Poa alpina, P. caesia, P. supina, Nigritella nigra, while other show connections with other arcto-alpine areas: Pinus cembra, Carex capillaris, C. tragalus australis, Leontopodium alpinum, Saussurea discolor. The regional elements in the thorn area central European alpine: Salix retusa, ALnus viridis, Rumex scutatus, Ranunculus oreophilus, Kernera saxatilis, Cardamine resedifolia, Saxifraga bryoides, S. cuneifolia, Geum montanum, G. reptans, Trifolium badium, Polygala alpestris, Viola alpina, Primula halleri, P. minima, Androsace lactaea, Soldanella pusilla, Gentiana punctata, G. excisa, G. frigida, G. utriculosa, Satureja alpina subsp. baumgartenii, Veronica aphylla, V. bellidioides, Tozzia alpina, Galium anisophyllum, Sabiosa lucida, Chrysanthemum alpinum, Homogyne alpina, Senecio carniolicus, Centaurea nervosa, Hypochoeris uniflora, Agrostis rupestris, A. alpina, Sesleria disticha, Carex curvula, C. sempervirens, Minuartia recurva, Biscutella laevigata var. alpestris, Euphorbia carniolica, Peltaria alliacea, Gentiana praecox, Achillea stricta, A. distans, Doronicum columnae, Senecio subalpinus, Cirsium waldsteinii, Scorzonera rosea, Festuca picta, and some Carpathian-Balkan species: Potentilla ternata, Senecio carpaticus, Sesleria coerulans, Crocus heuffelianus, Salix silesiaca. Silene petraea, Linum uninerve, Athamantha turbith subsp. hungarica, Festuca xanthina. There are also some Balkan-Illyrican species: Festuca dalmatica, F. panciciana. However, the most characteristic plants of this area are represented by Dacic species: Silene lerchenflediana, S. heuffelii, Gypsophila petraea, Draba comJacta, Ranunculus crenatus, Alyssum repens, Saxifraga luteo-viridis, S. rocheliana, S. cymosa, S. heucherifolia, Viola dacica, V. declineata, Bupleurum diversifolium, Symphytum cordatum, Pulmonaria rubra, Scrophularia lasiocaulis, Veronica bachofenii, V. baumgartenii, Asperula capitata, Campanula transsilvanica, C. abietina, Symphandra wanneri, Achillea lingulata, Centaurea kotschyana, Centaurea retezatensis, Alopecurus laguriformis, Sesleria rigida, Poa media, Lilium jankae. The plants which connect the Balkan, Caucasian and Dacic floral regions are important for the phytohistory of the area: Phleum montanum, Carex dacica, Chrysanthemum macrophyllum, as are those with Balkan-Anatolian relationships Bruckenthalia spiculifolia, Plantago gentianoides.

FAUNA The fauna is diverse, with different animals occuring at different altitudes. Mammals include wild boar Sus scrofa, which forms a high altitude

population, lynx Lynx lynx, wild cat Felis silvestris and roe deer Capreolus capreolus. Particularly characteristic of high altitudes is chamois Rupicapra rupicapra. The alpine marmot Marmota marmota is colonising successfully. The avifauna includes some capercaillie Tetrao urogallus in the spruce forest and the nutcracker Nucifraga caryocatactes is common in the Pinus cembra areas. Birds of prey include golden eagle Aquila chrysaetos, griffon vulture Gyps fulvus and European black vulture Aegypius monachus, lower vertebrates include Vipera berus and Triturus alpestris. In the rivers there are many trout Salmo fario and Thymalus thymalus. The insect fauna has not been well studied.

CULTURAL HERITAGE The area has been little influenced by man.

ZONING/CONSERVATION MANAGEMENT The core zone covers 1,850ha The area is very undisturbed, and the core zone is now strictly protected.

STAFF There are four wardens and two scientists

LOCAL ADMINISTRATION Academia Republicii Socialiste Romania, MAB National Committee of Romania, 71102 Calea Victoriei nr. 125, Bucaresti, Romania.

VISITOR FACILITIES Visitors are allowed access to the buffer zone.

SCIENTIFIC RESEARCH AND FACILITIES Past research has included inventories of the flora and fauna. Much work has been done on the palynology of the area, using remains from peat bogs, and pollen analysis from these and the lakes. Beech productivity and the role of Pinus mugo have been studied. Work is being carried out on the ecology and productivity of glacial lakes.

LOCAL POPULATION The area is very sparsely populated and little affected by man; some summer grazing however is allowed in the buffer zone.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has been little modified by man. In the Second World War forest fires caused much destruction in some parts of the park. Seasonal grazing occurs in the buffer zone.

PRINCIPAL REFERENCE MATERIAL

Kirby, K.J. and Heap, J.R. (1984). Forestry and Nature Conservation in Romania. Quarterly Journal of Forestry 78(3): 145-155.

Rosca-Letea Reserve

BIOGEOGRAPHICAL PROVINCE 2.29.11 (Pontian Steppe)

LEGAL PROTECTION Total

DATE ESTABLISHED The Rosca area has been protected since 1961 and the Letea Forest since 1978. The combined area was accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION The reserve is situated in the northern part of the Danube delta near the Ukranian border. 45°20'N, 29°30'E.

ALTITUDE 0-15m

AREA 18,145ha

LAND TENURE Government

PHYSICAL FEATURES This is a low-lying area of lakes, marshes and distributary channels of the Danube. It also includes an area of north-west-south-east orientated sand dunes, parallel to the coast up to 15m high, with depressions between. Much of the area is inundated at high tides.

VEGETATION Apart from the Letea Forest, which covers 2,745ha, the main vegetation is marsh. The forest occurs ina a series of bands along the dunes which are up to 250m long and 10m wide. The forest is luxuriant, with many climbing plants, many of the trees reaching 35m in height with diameters of up to one metre. At the edges of the forest the trees are much smaller and contorted. The forest consists of oak Quercus robur, Q. pedunculiflora, poplars Populus alba, P. nigra, ashes Fraxinus ornus, F. angustifolia, F. palisae, pear Pyrus pyraster, silver lime Tilia tomentosa, elm Ulmus sp., and occasional alder Alnus glutinosa. Among the shrubs are hawthorn Crataegus monogyna, Euonimus europea, Cornus mas, C. sanguinea, Rhamnus frangula, R. catharctica, Viburnum opulus, Berberis vulgaris, Hippophae rhamnoides, Tamarix spp. and occasional hazel Corylus avellana. The distinctive feature of the forest is the abundance of climbing plants, including Periploca graeca, Clematis vitalba, Vitis sylvestris and Humulus lupulus. In Spring, the ground is carpeted with lily of the valley Convallaria majalis. Particularly rare plants include Ephedra distachya and Merendera sobolifera. The marsh vegetation is dominated by reeds Phragmites communis which form floating or fixed islands with some Typha angustifolia. There are also water lilies Nymphaea alba and Nuphar luteus. On the edges of the marshes grow white willow Salix alba.

FAUNA The forest is noted for several rare reptiles, including Vipera ursini, Elaphe longissiuma, and Eremias arguta deserti. There are a number of raptors, including white-tailed sea eagle Haliaeetus albicilla, red kite Milvus milvus, black kite M. migrans and short-toed eagle Circaetus gallicus. On the floating islands on lake Hrecisca there is a large colony of 700-1,000 pelicans, eastern white pelican Pelecanus onocrotalus and dalmation white pelican P. crispus. Also nesting at the edges of the colony are common cormorant Phalacrocorax carbo and pygmy cormorant P. pygmaeus. There are a number of mixed heronries of purple heron Ardea purpurea, A cinerea, Ardeola ralloides, great white egret Egretta alba, cattle egret E. garzetta, little bittern Ixobrychus minutus and night heron Nycticorax nycticorax. Many colonies also include nesting glossy ibis Plegadis falcinellus.

ZONING/CONSERVATION MANAGEMENT The core zone covers two-thirds of the area. The peripheral areas form the buffer zone. Access to the area is strictly controlled, particularly during the breeding season. Hunting is not allowed at all, but reed cutting and fishing are allowed in the buffer zone, although there is a closed season for fishing.

STAFF The reserve is supervised by staff from the Commission for the Protection of Natural Sites and the Hunting and Fishing Association.

LOCAL ADMINISTRATION Academia Republicii Socialiste Romania, MAB National Committee of Romania, 71102 Calea Victoriei nr. 125, Bucaresti, Romania.

VISITOR FACILITIES Permission is needed to visit the reserve and it is closed during the bird breeding season.

SCIENTIFIC RESEARCH AND FACILITIES Faunal and floral surveys have been carried out.

LOCAL POPULATION The delta area is fairly sparsely populated. Local people can cut reeds by hand and fish in the buffer zone.

MODIFICATION OF THE NATURAL ENVIRONMENT Limited human use is made of the buffer zone. Intensive fish farming occurs just outside the reserve and limits the supply of food for many birds. In some areas, plant material has accumulated and reduced the nesting areas for some birds.

PRINCIPAL REFERENCE MATERIAL

Wirth, H. (1979). Nature Reserves in Europe. Edition Leipzig.

Parc national des Volcans

BIOGEOGRAPHICAL PROVINCE 3.20.12 (Central African Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Part of the park was protected in 1925. Albert National Park, which included the entire volcanoes area, was established in 1929 and divided in 1960 with the independence of Zaire. Current protection is under a Decree of 24 April 1974. Accepted as a Biosphere Reserve in 1983.

GEOGRAPHICAL LOCATION 15km north-west of the town of Ruhengeri in the Virunga massif of north-west Rwanda, on the Uganda and Zaire borders. 1°21'-1°35'S, 29°22'-29°44'E.

ALTITUDE 2,400-4,507m

AREA 12,500-13,000ha; contiguous to Virunga National Park (809,000ha) in Zaire and Gorilla Game Reserve (8,800ha) in Uganda. The area of Volcanoes National Park could be 12,000-16,000ha, depending on whether the plan area or estimate of true surface area is used. The problem arises from inaccurate base maps with significant errors of scale. A figure of 77,000ha is often quoted, which probably refers to the surface area in the 1950s of the entire southern section of Albert National Park. The Biosphere Reserve covers an area of 15,065ha.

LAND TENURE Government

PHYSICAL FEATURES The park contains Pleistocene volcanic peaks belonging to the chain which forms part of the watershed between the Nile and Zaire river systems. The peaks include Karisimbi, one of the highest mountains in Africa. Terrain is difficult and broken with steep slopes. The forested slopes are recognised as important water catchment areas for the surrounding agricultural lands. Outflow decreased dramatically with the decrease in park area between 1958 and 1978 when forest was cut to be replaced by Pyrethrum plantations. There is a high annual rainfall of 1,975mm at 3,030m, with a marked decrease to the west. Mean annual temperature is 9.6°C.

VEGETATION Vegetation varies considerably due to the large altitudinal range within the park. There is some lower montane forest (now mainly lost to agriculture). Between 2,400 and 2,500m, there is Neoboutonia forest. From 2,500 to 3,200m Arundinaria alpina (bamboo) forest occurs, covering about 30% of the park area. From 2,600 to 3,600m, mainly on the more humid slopes in the south and west, is Hagenia-Hypericum forest, which covers about 30% of the park. This is one of the largest forests in Africa with Hagenia abyssinica. The vegetation from 35-4200m is characterised by Lobelia wollastonii, L. lanurensis, and Senecio erici-rosenii and covers about 25% of the park. From 4300 to 4500m grassland occurs. Secondary thicket, meadows, marshes, swamps and small lakes also occur, but their total area is relatively small.

FAUNA The park is best known for mountain gorilla Gorilla gorilla berengei (T) with a population in 1980 of 250 in the area covered by the parc national des Volcans, and the Virunga National Park in Zaire, about 110 occurring in the former. This subspecies is endemic to Virunga Mountain and Bwindi Forest in Uganda. Other mammals include: elephant Loxodonta africana (T), black-fronted duiker Cephalophus niger, buffalo Syncerus caffer, spotted hyena Crocuta crocuta and bushbuck Tragelaphus scriptus. There are 178 recorded bird species that include Grauer's swamp warbler Bradypterus graueri (V) and

at least 13 species endemic to the Virunga and Ruwenzori Mountains including: handsome francolin Francolinus nobilis, Ruwenzori turaco Tauraco johnstoni, Ruwenzori flycatcher Batis diops, strange weaver Ploceus alienus, dusky crimson-wing Cryptospiza jacksoni and Shelley's crimson-wing C. shelleyi, and 16 endemic subspecies.

ZONING/CONSERVATION MANAGEMENT Zones have developed with general usage, but have no fixed boundaries. They are: research zone (between Karisimbi and Bisoke), tourism zone (Bisoke and between Bisoke and Sabinyo), and strict reserve zone. There is no buffer zone. A management plan is being developed and should be available soon. A public awareness programme on the park periphery aims to promote understanding of the park and stimulate local support. It includes creation of wildlife clubs in primary schools, park visits by local people, and film shows in the villages with Kinyarwanda commentaries. An IUCN/WWF mission in 1985 noted that there was perhaps insufficient interaction between the management of the park, and the scientific research done within it.

STAFF Some 45-55 staff: two administrative, 28 guards, specialist gorilla guides/trackers or hiking guides, and watchmen. Three Mountain Gorilla Project staff, and one full-time and two part-time MGP guide/trackers.

LOCAL ADMINISTRATION Office Rwandais du Tourisme et des Parcs Nationaux, PO Box 905, Kigali.

VISITOR FACILITIES The Mountain Gorilla Project, jointly financed by the African Wildlife Foundation (AWF), the Flora and Fauna Preservation Society (FFPS), Peoples Trust for Endangered Species (PTEF) and WWF has worked to improve tourism so as to achieve economic independence for the park. This has involved habituating four gorilla families to the presence of humans so that visitors can be guaranteed close-up views. Cooperation Belge has also contributed finance to set up a new park bureau/guest house and visitor reception complex, now approaching completion.

SCIENTIFIC RESEARCH AND FACILITIES There are general surveys on the ecology and status of bird populations, and intensive research on the mountain gorilla and its habitat has been carried out for the past 15 years, including a census in 1980 funded by WWF and New York Zoological Society. The Karisoke Research Centre has a resident director, a varying number of research scientists, about 15 trackers, and camp staff. The centre has poor access. There are meteorological stations in the park area.

MODIFICATION OF THE NATURAL ENVIRONMENT The main threat is the possibility of further excision of park areas by the Government for agricultural purposes, but this has now been halted. The park is already reduced to a size which may not be large enough to support viable populatons of some species were it not for the neighbouring protected areas in Zaire and Uganda. Lack of technical and administrative staff and absence of a buffer zone are problems, but their effect is exacerbated by population increase on the park periphery. Damage to agriculture in the periphery area, particularly by buffalo, seems to be increasing and could cause resentment from local people. Gorilla poaching affects both survival of the species in this area and tourism. Problems associated with tourism are: over-demand for gorilla viewing and degradation of upland habitats through trampling, but these can be controlled. Other problems include encroachment, illegal wood and bamboo cutting, and feral dogs. Grazing is now under control. The yellow duiker Cephalophus sylvicultor probably occupied areas that have been turned over to cultivation in the past 30 years and it has now disappeared from the park. Leopard

Panthera pardus (T) was also present, but there have been no records since 1979. Recently a number of gorillas have died of an unknown illness.

PRINCIPAL REFERENCE MATERIAL

Fossey, D. and Harcourt, A.H. (1977). Feeding ecology of free-ranging mountain gorilla. In: Clutton-Brock, (Ed.) Primate Ecology pp. 415-447. Academic Press, London.

Ghoit, C. and Ruwet, J.C. (1974). Le Parc national des Volcans (Rwanda) Zoologie et assistance technique. FULREAC, Liége. Pp. 321-334.

Goemines-Somirwa (1981). Evolution entre 1958 et 1979 du couvert forestier et du debit des sources dans certaines régions du Rwanda. Report by Prof. J.P. Harroy instigated by Geomines-Somirwa and produced under the auspices of IDR, Kigale.

IUCN/WWF Project 1578. Rwanda, Gorilla conservation and Nature and Environmental Education programme.

IUCN/WWF Project 1613. Primate Action Fund.

IUCN/WWF (1985). Rapport d'une mission au Zaire et Rwanda. IUCN/WWF, Gland, Switzerland.

Forêt classée de Samba Dia

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Traditional human intervention is allowed, but strictly supervised to avoid direct or indirect damage to the fauna.

DATE ESTABLISHED Protected as classified forest since 1936. Approved as a Biosphere Reserve in 1979

GEOGRAPHICAL LOCATION Located in the Fatick district in the Sine-Saloum region, 6km from the Atlantic Ocean. Centred 14°08'N, 16°45'W.

ALTITUDE 5-10m

AREA 756ha

LAND TENURE Government

PHYSICAL FEATURES This forest is situated close to the sea and is subject to the influence of Atlantic trade winds. The climate is cool and humidity high. Mean annual rainfall is approximately 800mm.

VEGETATION The coastal zone forests are similar to those of the Casamance, with species of the genera Elaeis, Daniellia, and Pterocarpus. The vegetation is dominated by Borassus aethiopum, but important species are: Acacia seyal forming pure stands in the lowest zones; Combretaceae, normal in this zone, are represented by Combretum glutinosum and Anogeissus leiocarpus; large trees of the sahelo-sudanian savanna are present. The most common species are: Borassus flabellifer, Acacia seyal, Combretum glutinosum, Detarium microcarpum, D. senegalense, Acacia senegal, A. albida, Pterocarpus erinaceus, Khaya senegalensis, Sclerocarya birrea, Prosopis africana, Sterculia setigera, Parinarium macrophyllum, Tamarindus indica, Cordyla africana, Parkia biglobosa, Cassia sieberana, Grewia bicolor, Anogeissus leiocarpus, Daniellia oliveri, Mitragyna inermis, Dichrostachys cinerea, Annona glabra, Terminalia macroptera, Piliostigma reticulatum, Ficus sp., Elaeis guineensis, Phoenix reclinata, Tamarix senegalensis, Chloris prieurii, Gloriosa simplex, Asparagus pauli-guilelmi, Aristida sp., Hibiscus asper, Cenchrus biflorus, Sesbania pachycarpa, Cassia obtusifolia, Cyperus podocarpus, Dactyloctenium aegyptium, and Nymphaea micrantha.

FAUNA Mammals include: patas monkey Erythrocebus patas, palm rat Xerus erythropus, red mongoose Herpestes sanguineus, bushbuck Tragelaphus scriptus, civet Civettictis civetta, red-flanked jackal Canis adustus, common jackal Canis aureus and bush hare Lepus whytei. Birds include: ground hornbill Bucorvus abyssinicus, red-billed hornbill Tockus erythrorhynchus, black dwarf-hornbill Tockus hartlaubi, grey plantain-eater Crinifer piscator, green pigeon Treron calva, red-eyed dove Streptopelia semitorquata, common francolin Francolinus bicalcaratus, Namaqua dove Oena capensis, long-tailed glossy starling Lamprotornis caudatus, Senegal fire-finch Lagonosticta senegala, Senegal coucal Centropus senegalensis, chestnut-bellied sand grouse Pterocles exustus, rose-ringed parakeet Psittacula krameri, black kite Milvus migrans, pied crow Corvus albus, African pygmy kingfisher Ispidina picta, white-backed vulture Gyps africanus, hooded vulture Necrosyrtes monachus, cattle egret Bubulcus ibis, speckled pigeon Columba guinea, Abyssinian roller Coracias abyssinica, hoopoe Upupa epops, palm-nut vulture Gypohierax angolensis, laughing dove Streptopelia senegalensis, spur-winged plover Vanellus spinosus, grey kestrel Falco ardosiaceus, intermediate egret Egretta intermedia, and

little egret E. garzetta. Reptiles include: rock python Python sebae, Nile monitor Varanus niloticus, green mamba Dendroaspis viridis, tortoise Geochelone sulcata, Nile crocodile Crocodylus niloticus (V), and puff adder Bitis arietans.

ZONING/CONSERVATION MANAGEMENT No information The preservation of the typical Borassus landscape necessitates the continuation of traditional human intervention and the management plan for the reserve takes this into account by allowing traditional collection of dead wood, wild fruits, medicinal herbs, gums and resins of Borassus plant parts by the local population who live outside the reserve. The peripheral areas of the reserve are farmed under contractual agreement, one of the clauses stipulating that a certain number of Borassus palms be left per hectare of cultivated land. Moderate grazing is practised in these areas in the dry season after harvesting.

STAFF One Engineer and one Technician from the Forestry Service

LOCAL ADMINISTRATION Inspecteur des Eaux, Forêts et Chasses, Kaolack, Sine Saloum.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The reserve offers great potential for research on man-environment interactions, particularly with Borassus palm use.

MODIFICATION OF THE NATURAL ENVIRONMENT Farming and grazing in peripheral areas.

PRINCIPAL REFERENCE MATERIAL
None listed

Delta du Saloum

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Law 64-46 of 17 June 1964 on state land; law 72-02 of 1 February 1972 relating to territorial organisation; law 72-25 of 19 April 1972 relating to rural communities. Code of hunting and protection of fauna.

DATE ESTABLISHED Established as a National Park by Decree no. 76-577, 28 May 1976. An international park with the Gambia is being planned. Accepted as a Biosphere Reserve in 1980 and listed as a Ramsar site in 1984.

GEOGRAPHICAL LOCATION The reserve is located 150km from Dakar, on the main road between Dakar and Banjul, and 80km from the town of Kaolack. 13°35'-13°55'N, 16°27'-16°48'W.

ALTITUDE 0-10m

AREA The Biosphere Reserve is 180,000ha, with a core zone of 73,000ha (the National Park). Four-fifths of the national park is marine, whereas the biosphere reserve comprises a 72,000ha marine sector, 23,000ha of flooded areas, and 85,000ha of terrestrial islands.

LAND TENURE The core area (the National Park) and part of the buffer zone are government-owned. The remainder belongs to the local community.

PHYSICAL FEATURES The park and biosphere reserve are in the Delta of the seasonal Sine and Saloum rivers, and the area includes many sand islands and lagoons, the Sangomar point and coastal waters, and the forests of Fathala. Most of the terrestrial area of the park is covered by mangroves, sand dunes, and open forest on sandy soils, and the distributaries of the delta at the coast are almost exclusively saline. The climate comes between the sudanese and the sudano-sahelian types characterised by a rainy season in July-October (maximum in August). The mean annual temperature is 28°C and mean annual precipitation 800mm.

VEGETATION The dominant element is mangrove, made up principally of four species: Rhizophora racemosa, R. mangle, R. harrisonii and Avicennia nitida. Behind this zone of mangroves are open flat areas: the tanns, denuded of all vegetation. There are, moreover, islands of herbaceous populations of halophiles of varying importance: Sesuvium portulacastrum, Philoxerus vermicularis, and Paspalum vaginatum. Fathala has a dry forest.

FAUNA Large mammals have probably never been abundant here. The fauna is, however, sudano-sahelien, and very varied, with many small mammals in the dry forest of Fathala. There are also bay colobus Colobus badius temmincki present. On the coast of particular note are the manatee Trichechus senegalensis (T) and hump-backed dolphin Sousa teuszii. Many seabirds nest on the deserted islands, including about 1,000 pairs each of lesser flamingo Phoenicopterus minor and greater flamingo P. ruber, 4,000 grey pelicans Pelecanus rufescens, and there are ten pairs of goliath heron Ardea goliath. Many wintering waders use the area. Reptiles are also well represented predominately by marine turtles, including olive ridley turtle Lepidochelys olivacea (E), green turtle Chelonia mydas (E), and loggerhead sea turtle Caretta caretta (V). It is an important fish spawning ground.

ZONING/CONSERVATION MANAGEMENT The core area of national park is surrounded by a buffer zone (which gives a total of just over 73,000ha). The classified forest zone, where exploitation is forbidden, comprises the forests of the islands of Saloum, Béhtanti, Sangako, and Fathala (around 70,000ha). Part of the groundnut lands and Point Sangomar and its fishing cooperative (around 90,000ha) are included in the buffer zone. A special faunal reserve has been establihed at Palmarin. Several administrative sectors are co-ordinated by a Park Conservator. There is an environmental education programme. The inhabitants of the biosphere reserve participate in its running and management through a rural council in liaison with national park and forest service authorities. Radios have been provided by IUCN/WWF Project 3113 to help safeguard the fish spawning grounds.

STAFF Some 37 personnel directed by a coordinator

LOCAL ADMINISTRATION Park warden, BP 307, Kaolack.

VISITOR FACILITIES Access is prohibited onto the sandy islands, but small motor boats can be hired to tour around them. There is tourist potential as the park is close to Dakar and the region of Sine Saloum is a centre for tourism. On the borders of the park, there are two campements, one near park headquarters with excellent facilities.

SCIENTIFIC RESEARCH AND FACILITIES There have been studies of birds and mammals, vegetation and water pollution, but little published. There is a meteorological station.

MODIFICATION OF THE NATURAL ENVIRONMENT There is a permanent threat to the mangroves by extension of rice culture and exploitation of forest in the Fathala area. Protection does not extend to the salt flats, or to the whole of the Fathala forest. There are, however, proposals to include the whole of the latter within the park. Other threats include: fire in the forest zone, excessive fishing, destruction of bird colonies, projects on reintroducing species such as antelope Hippotragus sp., and conflicts with industrial and agricultural development.

PRINCIPAL REFERENCE MATERIAL

IUCN/WWF Project 3113. Proposed Delta du Saloum International Park.
Larivière, J. and Dupuy, A. (1978). Sénégal: Ses parcs, Ses animaux. Editions Fernand Nathan, Paris.

Parc national du Niokolo-Koba

BIOGEOGRAPHICAL PROVINCE 3.04.04 (West African Woodland/savanna)

LEGAL PROTECTION Total

DATE ESTABLISHED Created as a Hunting Reserve in 1926, Forest Reserve in 1951 and a Fauna Reserve on 19 April 1953 and enlarged by Decrees of 1962, 1965, 1968 and 1969. Accepted as Biosphere Reserve and World Heritage Site in 1981.

GEOGRAPHICAL LOCATION Lying across the border between administrative regions of Sénégal-Oriental and La Casamance, on the River Gambia, close to the Guinea border in south-eastern Senegal. 12°30'-13°20'N, 12°20'-13°35'W.

ALTITUDE 16-311m (Mont Assirik)

AREA 913,000ha

LAND TENURE Government

PHYSICAL FEATURES The park is a relatively flat region, with small lines of hills reaching about 200m, separated by wide floodplains which become inundated during the rains. The whole area has superficial formations of laterite and sediments over Cambrian sandstone beds, which outcrop in places, and some metamorphic rock. The park is crossed by the River Gambia and its two tributaries, the Niokolo Koba and the Koulountou. The climate is of a soudanien type with a rainy season from June to October. The average annual rainfall is 1000-1100mm.

VEGETATION Vegetation varies from a southern-Soudanien type to Guinean with savanna predominant, more luxuriant vegetation along the course of the rivers and a varying cover of trees and bushes. This vegetation changes its character according to topography and soils. In the valleys and plains, there are vast areas of Vetiveria and herbaceous savannas dominated by Andropogon gayanus, occasionally associated with Panicum anabaptistum. Seasonally flooded grassland is typically composed of Paspalum arbiculare and Echinochloa. Dry forest is made up of Soudanien species such as Piliostigma thonningii, Pterocarpus erinaceus, Pericopsis africana, Bombax costatum, Burkea africana, Prosopis africana, Sterculia setigera, Ficus ingens, and Anogeissus leiocarpus. There are also areas of bamboo Oxytenanthera abyssinica. In the ravines and gallery forests are species indicative of a

south Guinean climate, with lianes very abundant, and species such as Raphia sudanica, Baissea multiflora, Nauclea latifolia, Dalbergia saxatilis, and Landolphia dulcis. On the slopes and hills, the rock outcrops, the alluvial sands and iron pans, the vegetation is different. On the edges of rivers occur semi-aquatic species such as Rotula aquatica, Hygrophila odora, Cyperus baikiei, and annuals, which disappear when the water level rises, are found in the periodically flooded sands. In and around the marshes, most of which are situated in abandoned riverbeds or behind the levées, the vegetation is very variable, depending on the height of the depression, water level, origins, soil structure and sub-soil. Certain ponds are bordered by dry forests, or herbaceous savannas, with species such as Arundinella ecklonii, Eriochrysis brachypogon, Hemarthria altissima, Hyparrhenia amoena, Vetiveria nigritana, and Andropogon gayanus depending on dampness and the compaction of the soil. Occasionally, the centre of a marsh is occupied by thick thorn bushes of Mimosa pigra. Marshes on higher ground have a reduced surface area and scanty soil, very acid and peaty, and vegetation includes Oryza brachiyantha (a wild rice), Bryaspis lupulina, Adelostemma senegalense, Berchemia discolor, and Genlisea africana. On high banks Acacia nilotica, Crateva religiosa, Diospyros mespiliformis and Ziziphus mucronata are dominant, localised species occur on the constantly humid low banks, such as Christiana africana, Cola laurifolia, Croton scarciessii, Cynometra vogelii, Diospyros elliotii, Syzygium guineense, Symmeria paniculata, and Ziziphus amphibia. River bank species also include Khaya senegalensis, Erythrophleum guineense, Ceiba pentandra, Detarium senegalense, Syzygium guineense, Afzelia africana, and Borassus. Some 1,500 plant species have been recorded and the listing continues.

FAUNA There are about 80 species of mammal, 330 species of bird, 36 reptiles, 20 amphibians, and 60 species of fish recorded, as well as numerous invertebrates. Carnivores include: leopard Panthera pardus (T), lion P. leo, and hunting dog Lycaon pictus (T). There are also buffalo Syncerus caffer, roan Hippotragus equinus, giant eland Taurotragus derbianus (about 1,000), Guinea baboon Papio papio, green monkey Cercopithecus aethiops sabaeus, patas monkey Erythrocebus patas, bay colobus Colobus badius temmincki, all three African crocodiles: Nile Crocodylus niloticus (V), slender-snouted C. cataphractus (I) and dwarf Osteolaemus tetraspis (I), four tortoise species, and hippopotamus Hippopotamus amphibius, which is present in all three large watercourses in the park. The park is the last refuge in Senegal for giraffe Giraffa camelopardalis and elephant Loxodonta africana (T). About 150 chimpanzee Pan troglodytes (T) live in the gallery forest of the park and on Mont Assirik (the north-western limit of their distribution). Birds include: Denham's bustard Neotis cafra denhami, ground hornbill Bucorvus abyssinicus, violet turaco Musophaga violacea, spur-winged goose Plectropterus gambensis, white-faced tree duck Dendrocygna viduata, martial eagle Polemaetus bellicosus and bateleur Terathopius ecaudatus.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone 1km wide and six administrative sectors, each of which contains surveillance posts. There is a general plan for management and restoration of natural ecosystems. Regional development plans recognize strict protection of the park. Some controlled burning is done to preserve savanna areas. WWF Project 1774 has supplied a land rover and radios to combat elephant poaching.

STAFF Over 200 personnel directed by a conservator and assistant

LOCAL ADMINISTRATION Parc Conservateur, PN Niokolo-Koba, Tamba-Counda, BP 37. IUCN/WWF Project 1774.

VISITOR FACILITIES There is a luxury hotel at Simenti, which is the most visited part of the park. There are also bungalows and an hotel at Niokolo-Koba, lodgings at Badi, and several camping grounds. Animals can be watched from hides or on guided safaris. Animals disperse in the rains, so best viewing times are from the end of October to the end of June, when tours are most organized. There is an airstrip at Simenti.

SCIENTIFIC RESEARCH AND FACILITIES Research is regarded as important with further details within the Memoirs of the IFAN of Dakar, particularly 1956, 1961, 1969, and 1982. An elephant survey was conducted in 1981 under IUCN/WWF Project 1774.

MODIFICATION OF THE NATURAL ENVIRONMENT The number of leopard and elephant in the park are decreasing because of the poaching over a number of years. The park is threatened by dams planned for the Gambia and Niokola-Koba Rivers, the creation of an artificial lake and increase accessiblity associated with industrial exploration including mining and quarrying. When the park was established, it was inhabited by people practising agriculture, cattle raising, and some hunting and bush fires were used to control the vegetation which resulted in degraded soils, the emergence of savanna vegetation, and the disappearance of large animals in some areas. However, all inhabitants were relocated outside the park area a decade ago, but areas outside and within the park are still burnt.

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Reserva de Grazalema

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION The Spanish fir area is fully protected. In the low zones where the terrain is not very hilly, cattle and sheep are allowed to graze with some restrictions. Hunting of partridge and rabbits is authorised in a part of the reserve (areas which are not fully protected), but there is a limitation on hunters and on the quantity of game taken. The fishing of trout and crab is prohibited at present, as is the hunting of goats, deer, roe deer and wild boar.

DATE ESTABLISHED January 1977 as a Biosphere Reserve

GEOGRAPHICAL LOCATION South-east of Sevilla, west of Malaga and east-north-east of Cadiz - almost equidistant. The northern boundary is that of the provinces of Cadiz and Sevilla. The eastern boundary is that of Cadiz and Malaga. The reserve lies entirely in the province of Cadiz. 36°15'-36°54'N, 05°20'-05°32'W.

ALTITUDE 250-1,654m

AREA 32,210ha

LAND TENURE State property: 6,606ha; property of local communities: 1,604ha; private property: 24,000ha.

PHYSICAL FEATURES A massif of karstic limestone, it has closed river basins: headstreams of the Guadalete and Majaceite Rivers and tributaries of the Guadiaro. Some of the waters of the massif flow into the Guadiaro through an underground watercourse (Cueva del Gato). The relief is very complicated and abrupt, comprising very jagged crests and cavernous karstic plateaux, with precipitous edges. The divide of the Sierra del Pinar is bounded on the north by a sheer rise of about 300m. This sierra, the highest in the province of Cadiz, stands like a great spur overlooking the whole territory. The substratum consists largely of Lias and Jurassic limestone. At the bases there are Triassic outcrops of chalk and loam and, irregularly distributed, quartzite sandstone strata of the Algibe stratigraphical formation. This massif receives the highest rainfall in the south of Spain and, owing to the form of the rainfall, it is known as the "little Spanish Himalaya". The average annual rainfall reaches 2500mm, with the maximum exceeding 4000mm. Intensities exceed 4mm/minute and it is quite usual to reach 300mm/day, the maximum recorded in one day being 365mm. The maxima occur from the Pinar peaks zone to Grazalema, and the rainfall is probably among the highest in Europe.

VEGETATION The reserve contains a wealth of floral diversity, with some 700 species of vascular plants catalogued to date. Eighteen higher vegetation types have been found, including eight principal climaxes. Thirty types of structure are to be found in the plant communities and 140 principal species have been identified. The core area comprises the 300ha of Spanish fir Avies pinsapo forest, which is clearly expanding at present. The principal species of the climax types are A. pinsapo, Acer monspessulanum, Quercus faginea alpestris, Q. suber, Q. ilex, Ceratonia siliqua, Juniperus phoenicea and Populus alba (Galleria). The region includes a splendid maquis of considerable extent. It is situated on a limestone substratum, but the soils are natural because of the high rainfall. It also has the best carob tree Ceratonia sp. woods in Spain. These are found up to an altitude of 1200m, mixing with pine and fir woods.

FAUNA The following are represented in the reserve: mountain goat Capra pyrenaica, roe deer Capreolus capreolus, wild boar Sus scrofa, griffin vulture Gyps fulvus, Egyptian vulture Neoptron percnopterus, rabbit Oryctolagus cuniculus, red-legged partridge Alectoris rufa and other species peculiar to the Bética.

ZONING/CONSERVATION MANAGEMENT The core area is to be fully protected after restocking with firs. This is the potential area of the fir forest with patches dominated by maple. The best carob tree (Ceratonia sp.) hills will also be protected, as will be the maquis in the sunny parts of the Sierra del Pinar and the shade of Albarracin. The remaining areas, in which Quercus ilex, Q. suber and Juniperus phoenicea are dominant, will be buffer zones.

STAFF One engineer, two experts, four rangers

LOCAL ADMINISTRATION Jefatura Provincial del ICONA, Avda. de Ana de Viya no. 3, Cadiz, Spain.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Studies are being carried out to delimit in detail the potential area of the pine forest. This is fundamental to the restocking of the Abietum. Work is continuing on the compilation and revision of the catalogue of vascular species. Catalogues of fungi, mosses and lichens can also be compiled. Current studies are directed towards gaining a knowledge of the structure, function and composition of communities, and of the causes and forms of evolution, whether progressive, regressive or horizontal. The study of systems began with the vegetation, as the fixed component in the area. Catalogues of animal species of the principal groups will be compiled in the near future, and integrated studies of the structure, composition, and internal and external dynamics of ecosystems will be carried out. The ICONA gives scientists interested in the zone, facilities for study and research.

MODIFICATION OF THE NATURAL ENVIRONMENT The whole area of the reserve has been profoundly changed by man. At present, after four years of protection, the Grazalema pine forest is rapidly evolving towards a state of equilibrium. On the karst-like hills the vegetation has greatly deteriorated due to the grazing of goats over the centuries, as well as by burning, brush fires, the cutting of wood for fuel, the rooting out of trees and the cultivation of plots of ground. A start has been made on the restocking of areas with standing shrubs or luxuriant creepers. If this restocking is to be extended, it will be necessary to purchase the areas which have become private property.

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Reserva de Ordesa-Vinamala

BIOGEOGRAPHICAL PROVINCE 2.16.06 (Iberian Highlands)

LEGAL PROTECTION The Vinamala Reserve is protected under Law No. 37/1966 by which it was established. The fauna is under special protection and the hunting of the following species is prohibited: Lagopus mutus and Capra pyrenaica pyrenaica. The Ordesa National Park which lies within the Vinamala Reserve is protected by Royal Decree of 16 August 1918, which established it as a national park. Regulations governing it were issued in the Official Gazette of the province no. 121 of 9 October 1918. On the basis of this, the fauna is fully protected and hunting of all species is prohibited. The flora is similarly protected and the gathering of plants is prohibited in most of the mountains and municipal lands governed by the local government law and by the law on mountains.

DATE ESTABLISHED Ordesa was established as a National Park 16 August 1918; Vinamala in 1966 as a Hunting Reserve; they were accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION On the French border on the slopes of the Spanish side of the Central Pyrenées, in the province of Huesca, north-east of Jaca. 42°30'-42°43'N, 0°07'-0°12'E.

ALTITUDE 875-3,941m

AREA Biosphere Reserve 51,396ha, including: National Park 15,709ha (expanded in 1978 from 2,046ha); Hunting Reserve 49,230ha.

LAND TENURE Mostly under public ownership

PHYSICAL FEATURES The Ordesa valley is a canyon with vertical walls, being the result of successive glaciations during the Quarternary period. The oldest rock formations are composed of granite and slate; at a later date great limestone masses were formed as in the case of Monte Perdido. It comprises the valley of the River Arazas, confluent with the River Ara at an altitude of about 1,000m, which after 10km, has a large number of waterfalls, these being one of the principal attractions of the valley. The massif of Monte Perdido and the heads of the valleys of Ordesa, Aniscola, Escuain and Pineta have been recently included in the Park. The mean annual rainfall is 1,400mm, which falls as snow during the months of November to March, and rain in March, June, September and December. Vinamala is extremely mountainous with an imposing massif formed by Hertzian folds which were subsequently modified by glacial action. The scenery is spectacular and unique. A number of rivers run through the reserve including the Ara, the Sia and the Qquas Limpias.

VEGETATION This consists of distinct types of woodland depending upon the altitude. Up to 1,200m there extends a mixed woodland consisting of beech Fagus sylvatica and some conifers, Pinus sylvestris being the predominant species which are replaced by the black mountain pine Pinus uncinata up to 2,200m. The highland meadows start here, reaching up to 2,800m. Other tree species are the ash Fraxinus sp., large-leaved lime Tilia grandifolia and grey willow Salix cinerea. The most important bush species is the box Buxus sempervivens, which grows to a height of three metres. Festuca rubra, F. eskiae, Agrostis tennuis and Trifolium montanum are found in the upper zones.

FAUNA The most important species are: Spanish ibex Capra pyrenaica (20-25 individuals), chamois Rupicapra rupicapra pyrenaica, hare Lepus europaeus, stoat Mustela erminea, pine marten Martes martes, beech marten M. foina, weasel Mustela nivalis, otter Lutra lutra, alpine marmot Marmota marmota, edible dormouse Glis glis, garden dormouse Eliomys quercinus and Pyrennean desman Galemys pyrenaicus. Birds include rock ptarmigan Lagopus mutus, capercaillie Tetrao urogallus, red-legged partridge Alectoris rufa, grey partridge Perdix perdix, golden eagle Aquila chrysaetos, peregrine falcon Falco peregrinus, goshawk Accipiter gentilis, short-toed eagle Circaetus gallicus, booted eagle Hieraaetus pennatus, and lammergeier Gypaetus barbatus (nests in valley). Also the swift Apus apus, chough Pyrrhocorax pyrrhocorax, jay Garrulus glandarius, woodpeckers, the short-toed treecreeper, Certhia brachydactyla, rock nuthatch Sitta neumayer, rock sparrow Petronia petronia, marsh tit Parus palustris, kingfisher Alcedo atthis and the dipper Cinclus cinclus which frequent the watercourses.

CULTURAL HERITAGE The reserve falls in a remote and isolated part of Spain where the people speak Aragonese, Castillian with an addition of local dialect. Contact with the outside world is limited which, combined with the austere environment, has given rise to a vivid folklore tradition that is highly influenced by fear of the devil and animism. The area has been settled for hundreds of years with cattle and sheep farming providing the principal means of support. During the Civil War, the area was heavily garrisoned and there is a tradition of small scale warfare arising from disputes of ownership.

ZONING/CONSERVATION MANAGEMENT Four zones are recognised: managed reserve zone, intermediate zone, extensive use zone, service zone. Access to certain areas is strictly controlled to avoid disturbing the chamois and the populations of ibex have been reduced locally to lesson the pressure. Only selected species are permitted to be hunted within the reserve.

STAFF Director of conservation, conservation manager, chief interpreter, forest technical engineer, chief of management, forest wardens

LOCAL ADMINISTRATION Servicio Provincial of ICONA, General de las Heras, 8 Huesca, Spain.

VISITOR FACILITIES Access to the reserve is limited by the terrain but adequate. There are numerous places to stay.

SCIENTIFIC RESEARCH AND FACILITIES There are inventories of fauna and flora, plus ongoing studies on the control and monitoring of fauna and vegetation as well as changes caused by public use. The creation of a support centre to assist with scientific field work and a basic laboratory for the collection, preparation and conservation of biological material, is foreseen.

LOCAL POPULATION There are several towns such as Sallent, Lanuza, Panticosa and El Pueyo within the reserve as well as local farming villages.

MODIFICATION OF THE NATURAL ENVIRONMENT There are various commons or "facerias" used for pasture land by neighbouring villages, including the area between the Tema and Ossau valleys and the Tema-Azun faceria. Three electrical low-tension lines and one high-tension line, three water pipelines for power stations, and the dams of Sarra and Arrieles lie within the reserve. It also includes the towns of Respumoso, Bachimana Alto and Bajo, as well as two telpher railways. The Ana-Mari mine has a mining concession in the municipality of Lanuza. here is great pressure caused by excessive demand for tourism in the highlands.

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Parque Natural del Montseny

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION A Royal Decree of September 1928 protects the eastern part of the massif (7,800ha). In 1971 the provincial administration approved a draft plan, establishing regulations for protecting the area. This is a preliminary to a Special Plan for the Montseny Unit, which is still in preparation.

DATE ESTABLISHED April 1978 as a Biosphere Reserve

GEOGRAPHICAL LOCATION At the eastern limit of the Catalan pre-littoral mountain mass; north of the pre-littoral depression between the regions of Valle Oriental, La Selva and Osona, between the valleys of the Congost River in the west and the Riera de Arbucies in the east. Administratively, it belongs to the provinces of Barcelona and Gerona. Limited by the villages of San Celoni, Breda, Arbucias, Viladrau, Ayguafreda and La Garriga. 41°47'N, 06°03'E.

ALTITUDE 270-1707m

AREA 17,372ha. A modified adjoining area adds 12,747ha.

LAND TENURE The Barcelona Provincial Council owns 13% of the area and may, by new purchase, increase its share to 35%. Less than 1% is owned by the state. The remainder is private property.

PHYSICAL FEATURES The area is geologically a horst; it is the highest part of the Catalan coastal range. Because of its structure and the hardness of the rocks (slates and granite strongly altered by contact metamorphism) the topography is very varied with long rocky slopes known locally as 'cingles' and 'esqueis'. The high relief and deeply incised rivers have produced waterfalls and gorges. Near the two highest peaks, Turo de l'Home-Les Agudes and Matagalls, there is a wide plateau. Above 800m there is periodic mist, averaging more than half the days each year.

VEGETATION This is the most important feature of the park. Because of differences in altitude and climate, the area contains communities ranging from typically mediterranean to subalpine. On the lower part (200-800m) holm oak Quercus ilex is abundant together with other mediterranean elements such as cork oak and pines Pinus halepensis, P. pinea and P. pinaster. Various shrub and herbaceous communities result from human activities. In the upper part of the mediterranean zone, holm oak gives way, on siliceous soils, to the

association of Quercetum mediterraneo-montanum at 500m in shade, and on sunny slopes from 700-800m. On these the mountain oaks can reach an altitude of 1,100-1,200m. In special localities communities of hazel and alder can be found. The presence of a relict community of Prunus lusitanica at 900m is notable. Chestnuts have been planted in many shady areas. Montseny also possesses some very localised oak communities: Buxeto-Quercetum pubescentis and Aceri-Quercetum petraeae between 500 and 1,200m; Quercetum petraeae catalaunicum in wet areas between 1,000 and 1,200m. Beech forest is most characteristic of Montseny and is present in many forms (Lyuxulo-Fagetum, Helleboro-Fagetum and Buxo-Fagetum) between 100 and 1,600m. Among the beech, between 1300 and 1600m, groups of fir Abies alba are found at the southern limit of its natural distribution. Deforestation has led to the formation of heath and broom communities (Violo-Callunetum and Prunello-Sarothamnetum scopariae). The alder Alnus catalaunicum grows beside torrents. At high altitudes there are subalpine communities of Juniperus nana and Festuca grasslands. The communities of Galeopsis segetum present in the stony soils and those of Saxifraga vayredana present on siliceous cliffs are of special interest; this last species is endemic to Montseny.

FAUNA Many animal species because of the diversity of habitats, but nothing of unusual interest.

ZONING/CONSERVATION MANAGEMENT The draft plan established two kinds of zone: Protected Nature Reserves, where all productive activity is prohibited, and Nature Reserves, where cultivation, cattle grazing and forestry can continue under strict control. Together these zones form the Montseny Natural Park. A further zone (pre-parque), in which farming, grazing and forestry may continue, but in which it will also be possible to build tourist accommodation based on what is already there, is planned on the edge of the park.

STAFF At the present there are seven guards, two families of farmers, four agricultural workers, and two foremen, all of them engaged by the Provincial Deputy Council. Occasionally this staff is reinforced by people of the Corporation staff. The Natural Parks and Environment Service of the Provincial Deputy Council operates at the technological and scientific levels.

LOCAL ADMINISTRATION Diputacion Provincial de Barcelona, Servicio de Parques Naturales y Medio Ambiente, C. Urgel 187, Barcelona 15, Spain.

VISITOR FACILITIES Tourism is intensive, mainly from the densely populated industrial zones of Barcelona and its hinterlands. Weekend tourism now reaches about one million people per year. There are numerous restaurants and some hotels, generally modest, in the park and its surroundings. A constant increase in the number of visitors is expected. The Barcelona Deputy Council already owns ten houses in several are of the park, to be used mainly as education and cultural centres, particularly for youth organisations.

SCIENTIFIC RESEARCH AND FACILITIES The originality and complexity of Montseny massif have been the topic for numerous research studies and doctoral theses in geography, geology and botany. Other important research is in progress, particularly in anthropology, structure and dynamics of landscapes and geological structure. The Special Plan intends to promote other research; one on limnology has already begun. A school and some nature trails will be set up. Work on both has begun (1977).

LOCAL POPULATION The permanent population in the area of the Natural Park is 208 inhabitants, of whom 56 are children (1973). Approximately half of the working population is devoted to farming in the form of stock rearing; the

rest work on guard duties, in restaurants, etc. In addition more than four million people are settled in an area within 50km of the park.

MODIFICATION OF THE NATURAL ENVIRONMENT The traditional agricultural economy of the Montseny massif has allowed the conservation of a large area of forests of oak and beech woods; the strongly inclined slopes have hindered agricultural exploitation. However, the smoother slopes of Turo de l'Home and Matagalls as well as the plateau of La Calma have been completely deforested for use as grazing and farming grounds; this activity has increased Calluna vulgaris and grass. The depopulation of the last hundred years has enhanced the development of shrubs and heaths in the abandoned fields, allowing reforestation.

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Reserva de la Biosfera de Donana

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Protected under state ownership from drainage, forestry plantation and excessive tourist exploitation.

DATE ESTABLISHED Accepted as Biosphere Reserve in 1980, Donana National Park was established under Law 91 of 28 December 1978. Preceeding legislation includes the creation of Donana Biological Reserve (1965); Guadiamar Biological Reserve (1969); Decree 2.412 declaring 34,625ha as national park (1969); and Decree 3.101 declaring a zone of Complete Refuge in the park (1973). Reclassification in 1978 increased the area of the park.

GEOGRAPHICAL LOCATION On the south coast of Spain, in the area delimited by the towns of Sevilla, Huelva and Cadiz; between the right bank of the Guadalquivir River and the Atlantic Ocean; the provinces of Huelva and Sevilla. 37°00N, 06°30'W.

ALTITUDE 0-40m

AREA 77,260ha

LAND TENURE State 13,569ha; municipal 11,692ha; private 31,955ha; and various organisations. The pre-park (buffer zone) is private property.

PHYSICAL FEATURES Situated on quarternary deposits: mainly sand dunes and groups of shifting dunes, some of which move very rapidly. Vegetation cover has stabilised some dunes and there are lagoons and marshy areas in the dune slacks. The phreatic level is fairly shallow. Almost half the reserve area comprises swamps on flat clay soil filled with muddy sediments (marismas) with features including: canals with slight elevations ("vetas" and "paciles") that have been carved by natural drainage; closed hollows "lucios" which hold still

water; and "ojos" - points at which ground water reaches the surface. The clay sediments of the marshes are rich in calcium and magnesium and the marismas form a diverse mosaic of microhabitats: pools, banks, streams, reedbeds and mudflats. The marismas flood in winter creating ideal conditions for large flocks of migrating birds. Mean annual temperature 17°C and mean annual precipitation 600mm. Rainfall is concentrated in winter with a peak of 110mm per month.

VEGETATION Plant communities on the dunes have Atlantic - North African affinities and a notable degree of endemism. Rhamno-Juniperetum macrocarpas communities occur on the outer dunes with Rhamno-Juniperetum sophora on the dry inland (established) dunes. Cold sand (Pseudoglei type) vegetation includes Oleo-Quercetum suberis (plantations of cork oak, olive trees and capers), Ficario-Fraxinetum angustifoliae and Viti-Salicetum atrocinerae. The heathland (matorral) vegetation varies with water availability. In the damp hollows Erica scoparia and E. ciliaris occur and on the drier ridges Rosmarinus officinalis, Lavandula stoechas and scattered trees such as Pinus pinea (introduced species), cork oak Quercus suber and Arbutus unedo (occidental Mediterranean communities). In the mobile dune system, there are species such as marram grass Ammophila arenaria, and camarina Corema album. The covering vegetation of the marsh depends on the conditions of the pools and the salt content of the soil. In the highest zones, species of seablite and glasswort Suaeda sp., Salicornia sp., Arthrocnemum sp., are found. The depressed zones of seasonal inundation are covered by sea club rush Scirpus maritimus, bulrush Schoenoplectus lacustris, rushes Juncus sp. and brackish water crowfoot Ranunculus baudotii. Freshwater lake communities are similar to classes Phragmitea, Littorelletea and Potametea of atlantic-european type. Brackish water swamp have communities similar to Spartinetea, Artrocnemetea and Ruppietea of an arid north-african type. Some 750 species of plants have been identified including two species new to science and at least 45 new to Europe.

FAUNA Contains most of the Mediterranean fauna with a few elements from North Africa and Europe which came down the Atlantic coast. Vertebrates are especially important. Species include eight fish, 10 amphibian, 19 reptile and 30 mammal. Species of particular importance include Valencia hispanica, Aphanius iberos, Testudo graeca, Latastes viper Vipera lastastie gaditana, spiney footed lizard Acanthdactylus erythrurus, Aquila adalberti, Porphirio porphirio, Aythya nyroca, Oxyura leucocephala, slender-billed gull Larus genei, stone-curlew Burhinus oedicnemus, squacco heron Ardeola ralloides. Imperial eagle Aquila heliaca adalberti, short-toed eagle Circaetus gallicus, booted eagle Hieraaetus pennatus, buzzard Buteo buteo, black Milvus migrans and red kites M. milvus, the kestrel Falco tinnunculus, and hobby Falco subbuteo, predominantly in the stablilized sands. Amongst the mammals of this zone are wild boar Sus scrofa, fallow deer Dama dama, red deer Cervus elaphus, lynx Felis lynx pardina, small spotted genet Genetta genetta, red fox Vulpes vulpes and common rabbit Oryctolagus cuniculus. The marsh lies on the west Europe to west Arica migration route and is indispensable as a winter habitat for several species of waterfowl such as the greylag goose Anser anser (flocks of up to 40,000), teal Anas crecca and wigeon Anas penelope. It is also a spring nesting area for Mediterranean and African birds including spoonbill Platalea leucorodia and greater flamingo Phoenicopterus ruber. Important breeding wetland species include marbled teal Anas angustirostris, ruddy shelduck Tadorna ferruginea and purple gallinule Porphyrio porphyrio. Flamingos have also nested on various occasions and have increased during the last few years. Carp Cyprinus carpio and eels Anguilla anguilla are common.

CULTURAL HERITAGE Donana has a known history of over 700 years. It was the favourite hunting reserve of Spanish kings such as Philip IV, Philip V and Alfonso XIII. It was owned by the Duchess of Alba and formed the backdrop of her portrait by Goya. The palace of Donana remains as a testimony to this exalted past.

ZONING/CONSERVATION MANAGEMENT 12,000ha core zone which constitutes a scientific reserve and 26,540ha buffer zone. Divided into scientific reserve area, managed nature reserve, intermediate nature area, reception and interpreters area, area for special use, historic-cultural area, restoration area.

STAFF Director of conservation, assistant director, conservation manager, tourism manager, infrastructural works manager, unit centre manager, education unit manager, management unit manager, restoration unit manager, veterinary surgeon, administrator, forest wardens.

LOCAL ADMINISTRATION Inspeccion Regional del ICONA in Seville

VISITOR FACILITIES There are many visitors

SCIENTIFIC RESEARCH AND FACILITIES Research is being carried out on certain endangered species, ecological interactions and population dynamics, contamination of water which drains into the park and studies on the regeneration of the park's water system. Donana Biological Station is dependent on the Consejo Superior de Investigaciones Cientificas.

LOCAL POPULATION Considerable local agricultural interests present a constant problem.

MODIFICATION OF THE NATURAL ENVIRONMENT The seasonal wet and dry cycle is vulnerable to the failure of winter rains (as occurred in 1980/81) which severely affects food supplies. There is excessive pressure from visitors, from tenancies of properties in park land (the major part of which are privately owned), problems of hydraulics, and from legal actions in the vicinity of the park. Salt build-up as a result of urbanisation which curtails the free-flow of water is strangling areas in the reserve and a proposed autoroute would also have serious consequences. Modification of the hydraulic regime of Donana by intensive agriculture and drainage is a serious and constant threat as is contamination by agricultural runoff all of which may cause irreversable damage.

PRINCIPAL REFERENCE MATERIAL

Moore, P. et al. (1982) Coto de Donana. New Scientist Nov 11.
Aritio, L.B. (1979). Parques Nacionales Espanoles. INCAFO: Madrid.

Reserva de la Biosfera de la Mancha Humeda

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION The judicial ordination which affects La Mancha Humeda is varied and is derived from the distinct legal classification affecting the distinctive units. Parque Nacional Tablas de Daimiel the core area has total protection under Decree 1874/73, Ratification Law 25/1980. Ruidera Lake: Natural Site of national interest. Order 31-10-1.933. Proposals to make it a

Natural Protected area. Alcazar lake: Refuge for aquatic birds (ICONA Resolution). Alcabozo, Retamar and Pedro Munoz lakes: social. Malagon valleys (plains): controlled hunting zone.

DATE ESTABLISHED Approved as a Biosphere Reserve in 1980, Daimiel was established first as a hunting reserve in 1966 and then in 1973 as a national park.

GEOGRAPHICAL LOCATION The pools (swamps) of this region follow an irregular distribution in the provinces of Ciudad Real, South Toledo, south-west of Cuenca west of Albacete. As far as the orography is concerned, the area is delimited to the west by the last foothills of the Toledo Mountains (Calderina and Malagon Sierras), to the south by the Calatrava Sierra and to the south-east and east by the Campo Montiel tableland. The large plain of the Mancha which has a well defined steppic character is only interrupted by smooth undulations. 39°16'N, 03°24'E.

ALTITUDE 600-700m

AREA 25,000ha, with large variations of this extension depending on seasonal climatic conditions.

LAND TENURE 1,200ha in the National Park are state-owned. The remainder is either privately owned or belong to the local communities.

PHYSICAL FEATURES Daimiel is a large slightly undulating plain which is flooded by the waters of two rivers - the Cigüela and the Guadiana. Because the water of the Cigüela is brackish and that of the Guadiana is soft, the mixture of the two at Daimiel creates an unusual ecosystem. There are numerous small islands the biggest being Isla del Pan which is about 30ha. The main rivers which run through the area (Guadiana, Cigüela, Riansares, Zancara, Corcoles) have a characteristic irregular hydraulic flow. Water levels change substantially during the course of the year and deposit gypsum, saline marl or clay. Maximum and minimum temperatures are respectively 40° and -15°C°; the mean annual precipitation is 400mm.

VEGETATION Europe reedmace Typha latifolia, common reed Phragmites communis and bullrush Scirpus lacustris are also abundant. Of the various submerged aquatic plants, various Chara spp. constitute a major source of food for waterfowl.

FAUNA These wetland areas are exceptional for their avifauna and are particularly important as nesting and wintering sites for many species such as black-necked grebe Podiceps nigricollis, purple heron Ardea purpurea, shoveller Anas clypeata, pochard Aythya ferina and a wide variety of other waterfowl. Rare species include white spoonbill Platalea leucorodia, greater flamingo Phoenicopterus ruber and black stork Ciconia nigra. Amphibians such as Rana ridibunda, Bufo bufo and Salamandra salamandra are common. Tortoises Emys orbicularis and water snakes Natrix natrix and N. maura are also found. Mammal species to be seen are the pole cat Putorius putorius, fox Vulpes vulpes and, rarely, the otter Lutra lutra. Weasel Mustela nivalis and wild boar Sus scrofa are frequent.

STAFF Total staff of seven

LOCAL ADMINISTRATION Delegacion de ICONA Ciudad Real Spain.

SCIENTIFIC RESEARCH AND FACILITIES Studies on meteorology, bird populations and water quality have been carried out. There is a research station.

LOCAL POPULATION Nearby are the towns of Daimiel and Villarrubia de los Ojos, both of which are densely populated. Most of the available agricultural land is devoted to vineyards although wool production is also important.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has been greatly modified by human activities. Canalisation of the rivers Guadiana and Cigüela have resulted in dessication of various wetlands and lakes in the Daimiel National Park. The water table has also been considerably lowered by the pumping and household and industrial waste is discharged into the main waterways.

PRINCIPAL REFERENCE MATERIAL

Bernis, F. and Campte, A. (1972). Informe sobre las Tablas de Daimiel y otras zonas humedas.
Coronado, R. (1972). Informe sobre las recursos naturales de la Mancha Humeda.
Coronado, R. (1973). Guia de Anatidas. ICONA.
Morillo, C. et al. (1973). Guia del Parque Nacional. ICONA.
Aritio, L.B. (1979). Parques Nacionales Espandes. INCAFO, Madrid.

Reserva de la Biosfera de las Sierras de Cazorla y Segura

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Protected as a resource reserve and hunting reserve under Spanish legislation.

DATE ESTABLISHED As Hunting Reserve in 1960; as Biosphere Reserve in 1983

GEOGRAPHICAL LOCATION 325km south of Madrid, in the province of Jaén.

ALTITUDE 600-2,100m

AREA 190,000ha with a core zone of 60,000ha

LAND TENURE State (96,000ha); local communities (32,000ha)

PHYSICAL FEATURES Includes the upper reaches of the River Guadalquivar, together with a vast reservoir built for hydroelectric power generation and extensive mountains and forests. The landscape is a mosaic of peaks, valleys, rocky gorges and vertical cliffs, and displays many typical karst limestone features. The two sierras are part of a great mountain massif (known as the "Spanish Switzerland") dominated by several peaks over 1800m with Empanades, at 2107m, being the highest. Rocks are largely from the Lower Cretaceous with pockets of Lias. Mean annual precipitation, frequently snow, varies between 500-1500mm and the mean annual temperature ranges from 8 to 16°C (dependant on altitude).

VEGETATION The forests are particularly notable. The dominant species between 600-1300m are Quercus ilex, Q. lusitanica, Q. pubescens and Pistacia lentiscus. Pinus halepensis is found within the altitudinal range 600-850m, P. pinaster between 850-1200m and P. nigra between 1200-1850m. The flora is extremely rich, and between 1,200-1,300 vascular species have been recorded a fifth of those recorded in Spain. Many are either rare or endemic to the

region, such as the Cazorla violet and two endemic Narcissus spp. Another plant of interest is the butterwort Pinguicula vallisneriifolia.

FAUNA The fauna is very rich, with 127 birds including the red-legged partridge Alectoris rufa, golden eagle Aquila chrysaetos, Bonnelli's eagle Hieraaetus fasciatus (both eagle species breed in the park), as well as peregrine falcon Falco peregrinus, red kite Milvus migrans, griffon vulture Gyps fulvus and Egyptian vulture Neophron percnopterus. The alpine accentor Prunella collaris, rock thrush Monticola saxatilis, blue rock thrush M. solitarius, wallcreeper Tichodroma muraria, ortolan bunting Emberiza hortulana and alpine chough Pyrrhocorax graculus occur in the mountains while the reservoir has attracted black-winged stilt Himantopus himantopus, gull-billed tern Gelochelidon nilotica, little tern Sterna albifrons and occasional breeding pratincole Glareola pratincola. The 36 mammal species include ibex Capra ibex, mouflon Ovis laristanica, red deer Cervus elephus and wild boar Sus scrofa. There are also seven species of amphibian and 18 species of reptiles.

CULTURAL HERITAGE Although the area is not densely populated, it has been inhabited since pre-historic times as indicated by the Rupestian paintings recently discovered in Cuevas de Pardis near the Segura river. There is evidence also of Iberian settlements dating from 2000BC, in particular those of Galera y Orce and los Banos de la Mauana. The germanic invasions are memorialised by the existence of Visigoth funeraries and traces of the Arab domination of the area remain in the names of local rivers and sites as well as various buildings such as the castle of Bujaraiza. Beginning in 1748 the forests of the Sierras were used by the Royal Navy to build boats for the expansion and protection of the Spanish Empire. Under the Ordinance of 1748 the Navy was granted the rights to the timber on the mountains bordering the Guadalquivir and Guadalimar rivers, a monopoly which ended only in 1811 when the rights were transferred to the State.

ZONING/CONSERVATION MANAGEMENT Zonation is presently under preparation. Populations of certain species such as ibex are controlled.

STAFF Seventy personnel

LOCAL ADMINISTRATION No information

VISITOR FACILITIES There is a visitor's centre as well as a number of summer camps built by the National Youth Institute which play an important role in environmental education.

SCIENTIFIC RESEARCH AND FACILITIES The area has been recognised as having great potential for scientific research. Access is easy. Many possibilities for accommodation exist and there is a field station with six houses for scientific personnel.

LOCAL POPULATION There are a few human settlements in the buffer zone.

MODIFICATION OF THE NATURAL ENVIRONMENT Grazing, agricultural activities, irrigation and regular forestry all occur within the reserve and can be expected to have an impact. Pressure from tourism is increasing.

PRINCIPAL REFERENCE MATERIAL

Duffey, E. (1982). National Parks and Reserves of Western Europe. Macdonald, London.

Ortuna, F. and de la Pena, J. (1979). Reservas y Cotos Nacionales de Caza. vol 4 Region Mediterranea.

Reserva de la Biosfera de las Marismas del Odiel

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Protected under a decree of 1968. There are rights for limited salt exploitation on 1300ha.

DATE ESTABLISHED First protected in 1968; accepted in 1983 as a Biosphere Reserve

GEOGRAPHICAL LOCATION North-west of Cadiz, at the mouth of the Odiel River Province of Huelva.

ALTITUDE Near sea level

AREA 8,728ha, with a core zone of 3,800ha

LAND TENURE State

PHYSICAL FEATURES This coastal area includes extensive marshland and the island of Enmedio.

VEGETATION Much of the area has marsh vegetation.

FAUNA The marshland of the reserve, particularly the island of Enmedio, is one of the most important sites for the migration and nesting of bird species in the whole Iberian Peninsula. The transitional ecosystems, between land and sea, offer suitable habitats to a great number of species.

ZONING/CONSERVATION MANAGEMENT Core zone of 3,800ha

STAFF Total of seven

LOCAL ADMINISTRATION No information

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES A number of studies have been conducted on the marshland ecosystems and its bird species. The area is also of archaeological interest. Research is currently carried out mainly by the Chair of Ecological Research of the University of Sevilla. Access to the marshlands of Odiel is easy due to an extensive marine and terrestrial communication network.

MODIFICATION OF THE NATURAL ENVIRONMENT Human activities consist mainly of salt extraction in the northern part of the reserve. Not more than 100 head of cattle are still allowed to graze. On the Saltes islands, controlled sport and commercial fishing is allowed.

PRINCIPAL REFERENCE MATERIAL
None listed

Reserva de la Biosfera del Canal y los Tiles

BIOGEOGRAPHICAL PROVINCE 2.40.13 (Macaronesian Islands)

LEGAL PROTECTION No information

DATE ESTABLISHED Established as Biosphere Reserve in 1983. A decision was taken by ICONA in 1982 to establish a protective regime as resource reserve.

GEOGRAPHICAL LOCATION In the north-eastern part of the island of La Palma, Canary Islands. Approximately 28°40'N, 17°40'W.

ALTITUDE 250-1,400m

AREA 511ha

LAND TENURE Government

PHYSICAL FEATURES No information

VEGETATION The reserve is covered by a "laurisilva" which is characterised by relict flora of sub-tropical character of great scientific interest which is only found within the Canaries Archipelago. A very high proportion of the flora species are endemic.

FAUNA With the exception of insects, the Canaries as a whole lack species diversity although there is a high degree of endemism. One possible explanation for the paucity of variety is that as the islands rose directly from the depths of the Atlantic Ocean and have had no direct contact with the continent of Africa, they simply never developed any fauna of the higher orders. Mammals such as the rabbit Oryctolagus cuniculus and mouflon were introduced and still survive on the island. An endemic sub-species of chough Pyrrhocorax p. barbarus is found only on La Palma, the crow Corvus corax tingitanus, the kestrel Falco tinnunculus canariensis, the doves Columba livia canariensis and C. trocaz bollii also occur. Also found are the Chaffinch Fringilla coelebs palmae and the blackcap Sylvia atricapilla atricapilla. The insect fauna has not been studied extensively. Notable for their size are a centipede Scolopendra morsitans and a black spider Latrodectes sp.

ZONING/CONSERVATION MANAGEMENT 53ha of the total area of the reserve are used for research purposes. The remainder constitutes a strict protection zone.

STAFF No information

LOCAL ADMINISTRATION No information

SCIENTIFIC RESEARCH AND FACILITIES The area is of key interest for scientific research, in particular as regards the laurisilva ecosystem. It is of easy access and accommodation can be obtained not far from the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has been slightly modified by human activities, with the construction of canals and tanks for water supplies.

PRINCIPAL REFERENCE MATERIAL No information

Reserva de la Biosfera del Urdaibai

BIOGEOGRAPHICAL PROVINCE 2.16.06 (Iberian Highlands)

LEGAL PROTECTION Protected by law governing land usage and city ordinance of 12 May 1956 and planning regulations of 23 June 1986.

DATE ESTABLISHED 1984

GEOGRAPHICAL LOCATION Located in northern Spain to the east of the city of Bilbao, the reserve encompasses the hydrographic basin of the Gernika-Mundaka river including the mouth of the Oca river. 43°20'N, 2°41'W.

AREA 22,500ha

PHYSICAL FEATURES The Urdaibai hydrographic basin is a gentle inclination, much influenced by torrential fluvial action and tectonic activities, which slopes down to the Atlantic to end in sheer cliffs broken by the outlets of various streams and rivers. These outlets have a softening effect on what is otherwise a somewhat severe landscape. Excavation by fluvial activity, particularly of the Oca river, has uncovered Triassic and Jurassic strata which are clearly evident in vertical cross-sections. Dolomites, chalk, clay and quartzite are all typical with sandy calcareous soils in the head of the valley. The average annual temperature is 14°C with an average annual precipitation of 1400mm at 100m.

VEGETATION The vegetation associations are well documented. Cantabrian woods composed of holm oak Quercus ilex and strawberry trees Arbutus unedo are found along the edges of the Mundaca estuary and in pockets of deeper soil there are chestnut trees Castanea sativa and oaks Q. robur. Phillyrea media, Ligustrium vulgare, Carnus sanguinea, Crataegus monogyna, Viburnum tinus, Rosa senperviruns and Rubus sp. are typically associated with these woods and Brachypodium pinnatun, Teucrium scorodonia and Geranium robertianum occur in the herbaceous strata of these communities. Mixed Cantabrian woods are also present composed of Fraxinus excelsior, Castanea sativa, Betula sp., Quercus robur and Salix atrocinerea amongst others. Deforestation has resulted in the spread of matorral and heath vegetation in which Calluna vulgaris, Erica cinerea, E. vagans, Daboecia cantabrica, Agrostis curtisii, Pseudoarrbenaterum longifolium, Molinia caerulea and Cisium filipendulum are found. Along the coast Genisra hispanica, Erica vagans, Daucus carota, Plantago maritima, Dianthus monspesulanum, Leucanthenum crassifolium and Festuca dumetonun are typical.

FAUNA A wide variety of fauna are found in the reserve including eight species of amphibians, ten of reptiles, 188 of birds and 25 species of mammals. Bufo bufo and Rana perezi are two common species of frog and B. calamita, Triturus helveticus and T. marmoratus are also found. Snakes such as Natrix natrix and N. maura and the lizards Lacerta vivipara and Podarcis muralis, the European mink Mustela lutreola, the polecat Putorius putorius, water rat Asricola sapidus, common shrew Crocidura russula and the mouse Micromys minutus are all typical of the area. Genets Genetta genetta, wild cats Felis silvestris and fox Vulpes vulpes are also found. The avifauna is particularly diverse with good populations of birds of prey: Falco tinnunculus, F. subbuteo, F. peregrinus, Buteo buteo, Circaetus gallicus, Accipiter nissus and Tyto alba for example, nesting colonies of herring gulls Larus argentatus and shag Phalacrocorax aristotelis. Other birds present include firecrest Regulus ignicapallus, black redstart Phoenicurus ochruros, kingfisher Alcedo atthis, wagtails Motacilla alba and M. flava and Cetti's warbler Cetti cetti.

ZONING/CONSERVATION MANAGEMENT There is a core area of 2,200ha of which 500ha are salt marshes and the remainder holm oak forest. Other parts of the reserve are restricted to agricultural use and still others are allocated for urban development. There is a management plan which sets out guidelines for the development and protection of the area. However, it is unclear whether specific active conservation measures are implemented or whether conservation extends only as far as planning control.

STAFF Approximately 50 people are officially associated with the reserve but none apparently work within it, in an administrative or management capacity.

LOCAL ADMINISTRATION Gobierno Vasco, Wellington 2, 01011 Vitoria-Gasteiz, Spain.

VISITOR FACILITIES There are a wide variety of places to stay in and around the area. There is also an information centre at Sukarrieta and one under construction at Ekoetxe.

SCIENTIFIC RESEARCH AND FACILITIES A detailed and lengthy study of the Gernika-Bermeo Estuary has been published. Additionally, academic work has been done on the vegetation, fauna and geology of the area. There is a scientific centre, a soil laboratory, a meteorological centre, living quarters for scientific personel and controlled experimental plots.

LOCAL POPULATION There are 45,000 inhabitants in the reserve distributed between Gernika and Bermeo and eleven farming and fishing communities.

MODIFICATION OF THE NATURAL ENVIRONMENT Afforestation with coniferous species Pinus has reduced the extent of broad leaf forests. There are a large number of people living within the reserve.

PRINCIPAL REFERENCE MATERIAL

Estudio Ecologico de Valle y Estuario de la Ria de Gernika-Mundaka (1984). Departamento de Politica Territorial Transportes y Turismo. Sociedad de Ciencias.

Reserva de la Biosfera "Sierra Nevada"

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Protected as a hunting reserve under Law 37 of May 1966. There are plans to upgrade its status to national park.

DATE ESTABLISHED 1986

GEOGRAPHICAL LOCATION Located in south-eastern Spain, approximately 90km south-east of Granada in the Andalusian provinces of Granada and Almeria. 36°56'-37°14'N, 2°45'-3°32'W.

ALTITUDE 400-3,482m

AREA 190,000ha

LAND TENURE State owned, 15,809ha; public lands, 84,738ha; privately owned, 124,453ha.

PHYSICAL FEATURES Sierra Nevada is the most important part of Penibética chain of mountains, the highest chain in the Iberian peninsula and one of the most important in Europe with higher elevations found only in the Alps. El Tiede at 3,717m is the highest in Spain and there are fourteen other peaks in the chain with altitudes over 3,000m. The relief of the Sierra is unique. The centre of the chain forms an elongated and depressed arch, an anticlinal fold, constituting a series of rounded slopes and gentle hillsides upon which the effect of Quaternary glacial action is clearly evident. The peripheral zones of the Sierra, although of lower altitudes, present a radically different aspect with abrupt drops, steep slopes and deep canyons, such as Los Alayos de Dilar, el Cerro de Trevenque and Las Caharros de Monachil. The central zone is largely slate with quartzites, gneiss, anfibolites, serpentinas, marbles and is over 200 million years old, arising from the transformations of ancient marine sediments. The gneiss and anfibolites stem from more modern volcanic material. Minerals such as iron and copper are found although not in economically exploitable quantities except at Alquife which is one of the most important sites for iron in Europe. In the zones peripheral to the centre of the chain, dolomites and limestone, which date from the Triassic, dominate the terrain. The reserve includes the highest elevations as well as some lower elevations, along the valleys of Lanjaron, Dilar and Manachil rivers. Lagoons and cirques of glacial origin are numerous particularly in drought years. The wide range of altitudes determines the climates which vary considerably. Precipitation declines from west to east with a maximum of 2241mm at 3428m. Snow is present for eight to nine months of the year. Temperatures range from a maximum of 29°C to -6.6°C during the year.

VEGETATION The vegetation of the reserve corresponds to three types of high mountain communities: cold deserts, tundra and leguminous and cupressaceous material. In the cold desert, above 2,900m the majority of the terrain is devoid of vascular plants, and only lichens are found. However in sheltered areas Festuca clementei, Agrostis nevadensis and Poa laxa may be found. In areas where water is abundant in summer, species of Ranunculus, Saxifraga, Villa and Erigenum may occur. Down to 2,200m, tundra vegetation covers the terrain with Carex fusca, Veronica repens, Leontodon microcephala, Festuca hallieri, C. nevadensis, F. violacea, Artoxantum adoratum and Trifolium nevadensis all typical. Below the tundra vegetation Arenaria pungens, A. tetraquetra, Sideritis glacialis, Thymus serpyllioides and Herniaria boissieri are typically found. Very little of the original forests remain although there are small enclaves of Pinus nigra and other pine Pinus spp. as well as a few of oak Quercus spp.

FAUNA Spanish ibex Capra pyrenaica, beech marten Martes foina, weasel Mustela nivalis, fox Vulpes vulpes, field mouse Apodeus sylvatius, garden dormouse Eliomys quercinus, genet Genetta genetta and wild cat Felis sylvestris are all found. The avifauna is diverse and includes golden eagle Aquila chrysaetos, kestrel Falco tinnunculus, peregrine F. peregrinus and Bonelli's eagle Hieraeetus fasciatus, all nesting in the area. Goldfinch Carduelis carduelis, serins Serinus serinus, lemon-breasted seedeaters S. citrinipectus, thrushes T. philomelos and T. viscivorus and red-legged partridge Alectoris rufa are common. Invertebrate species of note are the apollo butterfly Parnassius appollo nevadensis and the endemics Baetica ustulata, Eumigus monticulus, E. rubioi and Chorthippus nevadensis.

CULTURAL HERITAGE Because of the harsh climate in the higher elevations there are no permanent human settlements. In slightly lower altitudes, the mountains provided a refuge for Spanish Christians who did not wish to be assimilated into the Arab culture during the time of the Moorish occupation.

The rebellion against Omar-Ibn-Hafsun in the 9th century began in the Sierra Nevada, a situation which reversed itself in the last stages of the Reconquista when Arabs sheltered in the mountains. Their resistance was fierce, culminating in the rebellion of Aben-Humeya in 1568-70, which ended with the expulsion of the Arabs. During their time of occupation in the Sierra Nevada, the Moors implemented systems of soil and resource utilisation which were extremely advanced and which persisted until a few years ago. Following the departure of the Moors the area was repopulated by Christians most of whom were accustomed to farming dry, flatter lands, and who replaced the existing arboriculture with cereal crops and animal husbandry techniques which necessitated the deforestation of massive areas.

ZONING/CONSERVATION MANAGEMENT Divided into three zones; one of "intensive use", an intermediate zone where traditional uses are allowed to continue in the areas modified by man and a restricted zone where only observations and research are permitted and access is controlled.

STAFF No information

LOCAL ADMINISTRATION No information

VISITOR FACILITIES There are numerous places to stay in the reserve and access is easy owing to the gentle terrain despite the altitude. There are also tourist information centres and ski facilities.

SCIENTIFIC RESEARCH AND FACILITIES Various scientific studies have been conducted in the region for over 100 years particularly on the endemic plants, vegetation cover, geology climate and fauna and there is a large bibliography. A detailed ecological study was published in 1984.

LOCAL POPULATION 25 villages are located within the reserve with an additional 11 on the periphery.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has been extensively deforested and erosion of some areas has been serious. Furthermore development of the area for tourists and as a ski resort will have a serious impact, opening up previously isolated areas to large numbers of visitors. Hydro-electric projects have been in operation since 1958 and are regarded as important to the supply of cheap power.

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Hurulu Forest Reserve

BIOGEOGRAPHICAL PROVINCE 4.13.04 (Ceylonese Monsoon Forest)

LEGAL PROTECTION Partially protected under the provisions of the Forest Ordinance. (The area may be further protected under the proposed National Heritage Wilderness Areas Act, which is to be administered by the Forest Department.)

DATE ESTABLISHED Declared a biosphere reserve in January 1977.

GEOGRAPHICAL LOCATION Lies within Hurulu Forest between mile posts 120 and 122, along the Trincomalee-Colombo main road in North Central Province. 08°05'-08°20'N, 80°47'-80°55'E.

ALTITUDE 90-150m

AREA 512ha. Surrounded by some 25,500ha of forest reserve.

LAND TENURE Government (Administered by the Forest Department, under the authority of the Ministry of Lands and Land Development.)

PHYSICAL FEATURES Undulating topography with granite outcrops ranging in altitude from 90m to 150m. Mean annual rainfall is 1600mm. Mean annual temperature is 27.3°C.

VEGETATION A rich and diverse flora, comprising some 30 species of trees including Chloroxylon swietenia, Feronia limonia, Garcinia spicata, Diospyros sp. and Cassia fistula. 17 shrub species have been identified, together with 41 herbaceous species, of which the orchid Dendrobium maccarthiae is noteworthy.

FAUNA Mammals include loris Loris tardigradus, sloth bear Melursus ursinus (I), jackal Canis aureus, leopard Panthera pardus (V), elephant Elephas maximus (E), buffalo Bubalus bubalis (V), sambar Cervus unicolor, spotted deer Axis axis, porcupine Hystrix indica and bandicoot rat Bandicota sp. Information for other faunal groups is poorly documented.

ZONING/CONSERVATION MANAGEMENT The 512ha Biosphere Reserve core area is surrounded by 25,500ha of forest reserve that act as a buffer zone.

STAFF No information

LOCAL ADMINISTRATION Divisional Forest Officer, North Central Division, Trincomalee.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES No information

LOCAL POPULATION The reserve is uninhabited.

MODIFICATION OF THE NATURAL ENVIRONMENT Areas within the reserve have been logged and are subject to shifting cultivation.

PRINCIPAL REFERENCE MATERIAL

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Sinharaja Forest Reserve

BIOGEOGRAPHICAL PROVINCE 4.02.01 (Ceylonese Rainforest)

LEGAL PROTECTION Originally, partially protected under the provisions of the Forest Ordinance. Logging was banned in 1977, largely due to public pressure with the Wildlife and Nature Protection Society playing a leading role. The proposed National Heritage Wilderness Areas Act will provide additional protection with the declaration of the reserve as a national heritage wilderness area (Forest Department, 1986).

DATE ESTABLISHED Most of the reserve was declared a forest reserve on 3 May 1875 by notification in the Ceylon Government Gazette No. 4046, dated 8 May 1875. The rest was proposed as a forest reserve in the early 20th century. 7he reserve was declared a biosphere reserve in April 1978.

GEOGRAPHICAL LOCATION Situated in the south-west lowland wet zone of Sri Lanka, within Sabaragamuwa and Southern provinces. It is bounded on the north by the Napola Dola and Koskulana Ganga, on the south and south-west by the Maha Dola and Gin Ganga, on the west by the Kalukandawa Ela and Kudawa Ganga and on the east by an ancient footpath near Beverley Estate and by the Denuwa Kanda. 6°21'-6°26'N, 80°21'-80°34'E.

ALTITUDE Ranges from 300m to 1,170m (Hinipitigala Peak).

AREA 8,864ha, of which 6,092ha is reserved forest and 2,772ha is proposed as reserved forest. The entire area constitutes the biosphere reserve.

LAND TENURE Government (Administered by the Forest Department, under the authority of the Ministry of Lands and Land Development.)

PHYSICAL FEATURES This narrow strip of undulating terrain consists of a series of ridges and valleys. The reserve is drained by an intricate network of streams, which flow into the Gin Ganga on the southern boundary and Kalu Ganga, via the Napola Dola, Koskulana Ganga and Kudawa Ganga, on the northern boundary. The reserve lies within the transition zone of two important rock types characteristic of Sri Lanka. The south-west group consists of metasediments, charnockites and scapolite bearing calc-granulites while the highland group comprises khondalites of metamorphosed sediments and charnockites (Cooray, 1978). Most significant is the Sinharaja Basic Zone, consisting of hornblende pyriclasts, basic charnockites, pyroxene amphibolites and scapolite bearing calc-granulites and blended with small amounts of quartzites, garnet-biotite gneisses and intermediate charnockites (Hapuarachi et al., 1964). Soils, which largely belong to the red-yellow podzolic group, are well-drained and show very little accumulation of organic matter. Mean annual rainfall recorded for the area is 3,750-5,000mm, most of which is from the south-west monsoons during May-July and the north-east monsoons during November-January. There is no dry spell. Mean annual temperature ranges between 18°C and 27°C (Rosayro, 1959).

VEGETATION Sinharaja is the last extensive patch of primary lowland rain forest in Sri Lanka. Two main types of forest can be recognised. Remnants of Dipterocarpus forest occur in valleys and on their lower slopes, with D. zeylanicus and D. hispidus present in almost pure stands. Secondary forest and scrub occur where the original forest cover has been removed by shifting cultivation and in other places the forest has been replaced by rubber and tea plantations (Rosayro, 1954). Mesua-Doona (Shorea) forest, the climax vegetation over most of the reserve, covers the middle and upper slopes above

500m (Rosayro, 1942) or above 335m as suggested by Gunatilleke and Gunatilleke (1985). Garcinia hermonii followed by Xylopia championii invariably dominate the understorey tree stratum, a range of species dominate the subcanopy and Mesua nagassarium usually predominates in the canopy layer (Gunatilleke and Gunatilleke, 1985). Of Sri Lanka's 830 endemic species, 217 trees and woody climbers are found in the lowland wet zone (Peeris, 1975). Of these, 139 (64%) have been recorded in the reserve (Gunatilleke and Gunatilleke, 1985), 16 of which are considered to be rare (Gunatilleke and Gunatilleke, 1981). Other rare endemics are the palm Loxococcus rupicola (R) and Atalantia rotundifolia, the latter being restricted to Sinhagala at 742m. Of 211 recorded species of trees and woody climbers, 40% have low population densities (less than or equal to 10 individuals per 25ha) and 43% have restricted distributions, rendering them vulnerable to further encroachments into the reserve (Gunatilleke and Gunatilleke, 1981). A variety of plants of known benefit to man are present of which Caryota urens (for jaggery, a sugar substitute), Calamus sp. (for cane), Elletaria ensal (as spice), Shores spp. (for flour), Shorea spp. (for varnish and incense) and Coscinium fenestratum (for medicinal purposes) are used intensively by villagers. A list of 202 plants, together with their endemicity and uses is given in the draft conservation plan (Forest Department, 1985).

FAUNA Preliminary lists of the fauna (viz mammals, birds, reptiles, amphibians, fishes and butterflies) have been compiled (March for Conservation, 1985) and are included in the draft conservation plan (Forest Department, 1985). Endemism is high, particularly for birds with 19 (95%) of 20 species endemic to Sri Lanka present. Endemism among mammals and butterfiles is also greater than 50%. Threatened mammals are leopard Panthera pardus (V) and elephant Elephas maximus (E). Birds considered to be endangered or rare (Hoffmann, 1984) are Sri Lanka wood pigeon Columba torringtoni, green-billed coucal Centropus chlororhynchus, Sri Lanka white-headed starling Sturnus senex, Sri Lanka blue magpie Cissa ornata, ashy-headed babbler Garrulax cinereifrons and Sri Lanka warbler Bradypterus palliseri, all of which are endemic, and red-faced malkoha Phaenicophaeus pyrrhocephalus. Of the reptiles and amphibia, the python Python molurus is vulnerable and a number of endemic species are likely to be threatened. Threatened freshwater fish are combtail Belontia signata (R), smooth-breasted snakehead Channa orientalis (R), black ruby barb Barbus nigrofasciatus (V), cherry barb Barbus titeya (V) and red-tail goby Sicydium halei (V), the conservation status of which is considered in Evans (1981). Of the 21 species of endemic butterfly, the Sri Lanka rose Atrophaneura jophon is vulnerable (Collins and Morris, 1985).

CULTURAL HERITAGE The Sinharaja region has long featured in the legends and lore of the people of Sri Lanka and is popularly believed to have belonged to the ancient kings. Its name, literally meaning lion (sinha) king (raja), perhaps refers to that original 'king-sized or royal forest of the Sinhalese', the people of Sri Lanka being mainly Aryan Sinhalese of the legendary 'lion-race' (Hoffmann, 1979).

ZONING/CONSERVATION MANAGEMENT In order to ensure the strict protection of the reserve for scientific and aesthetic reasons, a scheme of zonation and management for areas outside the reserve is proposed in the conservation plan. The creation and propagation of essential forest products, for sustained utilisation, in areas outside the reserve is intended to meet local needs and thereby eliminate former dependence on resources within the reserve. Alternative strategies are either to establish a 3.2km wide buffer zone round the reserve or to enlarge the area protected to about 47,380ha, with the reserve forming a strictly protected core area and surrounding areas

set aside as buffers for various uses. The plan advocates the resettlement of villagers living inside the reserve (Forest Department, 1986). Owing to its inaccessibility and steep, hilly terrain, the reserve remained untouched until 1968 when a government directive was issued to extract timber for the plywood sawmill and chipwood complex established at Kosgama. From 1971 until forestry operations were halted in 1977, about 1,400ha of forest in the western sector were selectively logged (Gunatilleke, 1978; Forest Department, 1986). Presently, the reserve has 6,500-7,000ha of unlogged forest. Since 1977, the Forest Department has given high priority to protecting the reserve and in 1978 began planting Pinus caribaea along the periphery to establish a live boundary. Recognising the need for special legislation to protect the reserve, the Forest Department plans to declare Sinharaja as a national heritage wilderness area under the proposed National Heritage Wilderness Areas Act.

STAFF Three Forest Rangers, four Beat Forest Officers (1985). One Assistant Conservator of Forests, three Forest Rangers, six Beat Forest Officers and 12 Forest Watchers are proposed in the conservation plan. This total of 22 officers is higher than that of 17 proposed by the Forest Department for 1985-1987.

LOCAL ADMINISTRATION Forest Ranger, Forest Office, Kudawa, Manane, Ratnapura (An Assistant Conservator of Forests will eventually be responsible for implementing the conservation plan.)

VISITOR FACILITIES Visitors are low in number and mostly naturalists. There are nature trails to the peaks of Moulawela and Sinhagala. Some accommodation is available with the Forest Department near the reserve entrance at Kudawa. Further facilities are planned.

SCIENTIFIC RESEARCH AND FACILITIES Among the earliest studies are those of Baker (1937, 1938). Rosayro (1954, 1959), Andrews (1961) and Merritt and Ranatunga (1959) assessed the area's potential for selective logging, based on aerial and ground surveys. Gunatilleke and Gunatilleke (1980, 1981, 1985) examined the floristic composition and phytosociology of woody vegetation and assessed its conservation value. Research on the endemic fauna has been undertaken by WWF/IUCN (Project 1733) and March for Conservation (Karunaratne et al., 1981). The Forest Department has provided a research hut in the reserve. A research camp at Veddagala, outside the reserve, is used by scientists.

LOCAL POPULATION There are two villages within the south-west of the reserve and about 52 families live in the northwestern sector. At least 20 other settlements occur on the periphery, an unknown number of which have been illegally established on state land without approval from the relevant authorities. Some land adjacent to the reserve is under private ownership, including small tea and rubber plantations. The extent to which local people are economically dependant on rain forest resources is variable but about 8% of households might be completely dependant (Silva, cited in Forest Department, 1985).

MODIFICATION OF THE NATURAL ENVIRONMENT Of the many constraints to the protection of the reserve, socio-economic ones relating to the people and organisations in the immediate vicinity of the reserve are perhaps the most important. Encroaching cultivations are probably the biggest problem, particularly along the southern boundary (McDermot, 1985). Contractors open up routes to facilitate logging operations and, although no felling is permitted within 1.6km of the reserve boundary, this may render the reserve

more accessible to illicit timber operations. Alleged malpractices by the State Timber Corporation are a source of concern for the Forest Department. Private land owners along the periphery perhaps make illegitimate use of timber resources within the reserve as, having felled all merchandable timber within their own land, they continue to request permits for timber (Hathurusinghe, 1985). The most important forest produce is firewood, significant quantities of which are used in the production of jaggery (McDermot, 1985; Silva, cited in Forest Department, 1985). The traditional use of minor forest products, most important of which are kitul for resin and wewal (cane), is now restricted to forest surrounding the reserve. Illicit gem mining was considered to be a serious problem in eastern parts of the reserve. It is organised mostly by wealthy merchants from outside the Sinharaja region and needs to be eradicated. The lack of a uniform land-use policy and the multiplicity of governmental and semi-governmental agencies involved in land-use planning in Sri Lanka are the major administrative constraints in evolving a suitable protection plan for Sinharaja. For the moment, transactions related to lands surrounding the reserve are suspended under presidential order until such time as the conservation plan for the reserve is ready for implementation (Forest Department, 1986).

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Dinder National Park

BIOGEOGRAPHICAL PROVINCE 3.13.07 (Eastern Sahel)

LEGAL PROTECTION Within the buffer zone charcoal licences are granted by the Forestry Department and concessions for mechanised farming are given by the Ministry of Agriculture in the wet season.

DATE ESTABLISHED 1935 as a National Park, May 1979 as a Biosphere Reserve. Extended to include a buffer zone in 1980.

GEOGRAPHICAL LOCATION The area lies in the north-eastern corner of the Blue Nile Province adjacent to the frontier with Ethiopia. 11°45'-12°50'N, 34°46'-36°12'E.

ALTITUDE 700-800m

AREA 639,700ha, with a 277,300ha buffer zone; Biosphere Reserve 650,000ha.

LAND TENURE Government

PHYSICAL FEATURES Much of the park is low-lying flood plain sloping gently from the Ethiopian Highlands with the meandering Rahad and Dinder rivers flowing north-westerly towards the Blue Nile. A number of tributary streams and ox-bow lakes (or mayas) cover a great deal of the total area towards the Ethiopian highlands, and in the southern corner of the park there are a few rocky hills. Precipitation ranges from 800mm in the south to 600mm in the north and falls mainly between June and October. Temperatures range from 20°C in January to 44°C in May.

VEGETATION There is Acacia seyal-Balanites aegyptiaca thornbush savanna, with tall, coarse grasses including Sorghum species in the north, and Combretum hartmannianum woodland in the south. Along the banks of rivers is Hyphaene thebaica or multi-layered gallery forest of Acacia sieberana, Tamarindus indica and Ficus species, with Ziziphus abyssinica and Mimosa pigra underneath. Again, the dominant grasses are Sorghum species and Brachiaria species. In swampy areas or shallow lakes, Nymphaea spp. and Ipomoea spp. are dominant. Open grass plains are composed of Themeda triandra, Panicum spp., Hyparrhenia spp. and Cynodon spp. The ox-bow lakes, which gradually silt up, provide the main source of nutritious grasses, particularly Echinochloa species, for wildlife during the most severe part of the dry season.

FAUNA There was a rich fauna including giraffe Giraffa camelopardalis, buffalo Syncerus caffer, reedbuck Redunca arundinum, roan antelope Hippotragus equinus, waterbuck Kobus ellipsiprymnus, greater kudu Tragelaphus strepsiceros, bushbuck T. scriptus, topi Damaliscus lunatus, oribi Ourebia ourebi, elephant Loxodonta africana (T), lion Panthera leo, leopard P. pardus (T), cheetah Acinonyx jubatus (T), striped hyena Hyaena hyaena and spotted hyena Crocuta crocuta. Numbers have been reduced over the last two decades. There was also a rich variety of birdlife including ostrich Struthio camelus.

ZONING/CONSERVATION MANAGEMENT The whole 650,000ha Biosphere Reserve area is considered as core, fully protected, but with limited tourism allowed. The large buffer zone which lies to the west may include some wet-season grazing areas.

STAFF Three game officers and 11 rangers. Research staff visit the park seasonally.

LOCAL ADMINISTRATION Wildlife Administration, PO Box 336, Khartoum.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Surveys from 1971-1977 by the Institute of Environmental Studies and the Wildlife Research Section at the University of Khartoum.

MODIFICATION OF THE NATURAL ENVIRONMENT The park only includes dry-season habitat for many ungulates and ostrich. Illegal mechanized farming is threatening the whole buffer zone and the traditional grazing lands outside the reserve are being lost. Burning, both by rangers and nomadic herdsmen, disturbs about 60% total area each year. The combination of the effect of this activity and grazing has caused remarkable changes in the vegetation. In addition, the livestock herds are thought to be responsible for the serious outbreaks of disease that have decimated the wild herds. Poaching is a serious threat. Surveys have shown that numbers of animals decreased by up to 50% between 1971-1977. Phase II of the Rahad Agricultural Project envisages a canal from Roseires Dam across the south-western buffer zone close to the park, which would block the wet season migration of many species as the agriculture does. Surveys were carried out in 1971-72 on migratory habits, and longer-term studies initiated. These surveys recommended that the canal be re-aligned to interfere less with migration routes and that a new game reserve be established to the west of the park to cover part of the wet season ranges of many animals (Dasmann 1972).

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Radom National Park

BIOGEOGRAPHICAL PROVINCE 3.05.04 (East African Woodland/savanna)

LEGAL PROTECTION Hunting is prohibited by the Sudan Game Regulation in force since 1960. No hunting, tree felling, agriculture, or new human settlements are allowed.

DATE ESTABLISHED 1979 as a Biosphere Reserve. National Park status in 1980

GEOGRAPHICAL LOCATION Located in the south-western corner of southern Darfur Province, 300km from Nyala, bordering the Central African Republic. Approximately 9°50'N, 24°45'E.

ALTITUDE Average of 450m

AREA 1,250,970ha

LAND TENURE Government

PHYSICAL FEATURES There is broken hilly country, with two main rivers and numerous smaller streams flooding only during the wet season. The mountain range within the reserve constitutes a watershed dividing the Central African and Sudanese hydrographical system. Rainfall occurs mainly between April and November and varies between 630mm in the north and 900mm in the south.

VEGETATION The savanna woodland is dominated by Terminalia brownii, Combretum spp., Anogeissus leiocarpus and Isoberlinia doka. Important for wildlife are the wet meadows (dahls) which provide water and fodder during the dry season.

FAUNA The park had a rich fauna which has become depleted. It includes elephant Loxodonta africana (T), hartebeest Alcelaphus busephalus (T), waterbuck Kobus ellipsiprymnus, kob K. kob, hippopotamus Hippopotamus amphibius, giraffe Giraffa camelopardalis, and a number of carnivores including: lion Panthera leo, leopard P. pardus (T), wild dog Lycaon pictus (T), and cheetah Acinonyx jubatus (T).

ZONING/CONSERVATION MANAGEMENT None

STAFF Thiry-four scouts and 12 officers

LOCAL ADMINISTRATION Wildlife Administration, PO Box 336, Khartoum.

VISITOR FACILITIES NO information

SCIENTIFIC RESEARCH AND FACILITIES There is high scientific potential but only two reconnaissance surveys were carried out in 1976 with the assistance of WWF and by the Wild Life Research Institute of Sudan. The area may become important as a site for desertification studies within MAB Project 3 and studies on feeding habits and migratory routes within MAB Project 8.

MODIFICATION OF THE NATURAL ENVIRONMENT For a long time the park was protected from cattle encroachment by the presence of tse-tse fly but recently there have been reports of livestock overgrazing. Poaching, honey collection and fishing have always occurred on a small scale but for a long time organised poaching has been the largest threat to the park. Human settlement is also increasing in and on the periphery of the park (Badawi and Hakim 1985).

PRINCIPAL REFERENCE MATERIAL

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Parc national Suisse

BIOGEOGRAPHICAL PROVINCE 2.32.12 (Central European Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Established by Federal Act in 1914 as a National Park, and accepted in May 1979 as Biosphere Reserve.

GEOGRAPHICAL LOCATION Eastern Switzerland in the Canton of Grisons adjacent to the Italian Stelvio National Park. 46°35'-46°45'N, 10°00'-10°20'E.

ALTITUDE 1,500-3,174m

AREA 16,870ha

LAND TENURE Commues of Schanf, Zernez, Scuol and Valchava, rented by the Swiss Confederation on indefinite lease.

PHYSICAL FEATURES The area is mountainous, with several magnificent peaks including Piz Quattervals at 3,165m, separated by deep, narrow valleys with many streams. There are extensive winter snowfields but no permanent glaciers. About a third of the area is bare rock or scree. Most of the rocks are dolomitic and produce calcareous soils. In the Val Trupchun and at Munt La Schera there is older rock where three great crystalline domes converge. The climate is continental with an annual precipitation of only about 900mm.

VEGETATION About a third of the park is forested, a third alpine grassland and the rest bare rock or scree. About half of the forested area consists of dwarf mountain pine Pinus montana and is the greatest concentration of this species in Switzerland. Below this the main trees are Scots pine P. sylvestris, arolla pine P. cembra, larch Larix decidua and Norway spruce Picea abies. Broadleaved trees are scattered, mainly white birch Betula pubescens, green alder Alnus viridis, aspen Populus tremula and rowan Sorbus aucuparia. The tree line is about 2,350m and above this grow many herbaceous plants, including anemone Pulsatilla vernalis and edelweiss Leontopodium alpinum. Over 640 species have been recorded in the park. The Engadine valley, on the park's northern edge, is the only one in Switzerland to drain into the Danube, and several plants usually found further east have probably spread via the valley, including Melica transilvania and Sisymbrium strictissimum.

FAUNA The original fauna is intact except for the wolf Canis lupus, brown bear Ursus arctos and lynx Felix lynx which have been exterminated and includes 30 species of mammal. There is a large summer population of red deer Cervus elaphus (about 2,000). Populations of chamois Rupicapra rupicapra (1,000) and ibex Capra ibex (150) live in the park all the year. About 100 species of bird occur with 60 nesting species, which include 12 individuals of golden eagle Aquila chrysaetos, capercaillie Tetrao urogallus, nutcracker Nucifraga caryocatactes, black woodpecker Dryocopus martius and ptarmigan Lagopus mutus. Smaller birds include alpine accentor Prunella collaris, ring ouzel Turdus torquatus, wall creeper Tichodroma muraria, snow finch Montifringilla nivalis, alpine chough Pyrrhocorax graculus and raven Corvus corax.

CULTURAL HERITAGE The park was one of the first established in Europe and became a model for others. Until the nineteenth century the forests were exploited for charcoal to smelt local iron ore.

ZONING/CONSERVATION MANAGEMENT None The whole area is strictly protected and well managed. Information boards are located at every car park and roadside barricaded to prevent other parking (Schloeth, 1977). Visitors are restricted to marked paths. There is a new national park centre outside its boundaries at Zernez. A long history of research has aided management decisions. Ibex have been successfully reintroduced.

STAFF Twelve employees involved in protection and maintenance

LOCAL ADMINISTRATION Directorate and Administration, Maison du parc national, CH-7530 Zernez.

VISITOR FACILITIES Access is unrestricted but visitors limited to marked paths and the park is inaccessible on foot in winter. The Park House at Zernez is open from June to October and includes exhibitions, a lecture theatre to seat 90 people, library, administrative offices, laboratories and research facilities. A road from Zernez runs through the park and there are several car parks and a hotel at Il Fuorn.

SCIENTIFIC RESEARCH AND FACILITIES Intensive research has been carried out since the establishment of the Park with 75 publications. About 30 people carry out research in the Park each year. Some interdisciplinary research projects were begun in 1976. There are facilities at the laboratory, built in 1946, near Il Fuorn and the Park House at Zernez.

LOCAL POPULATION No information

MODIFICATION OF THE NATURAL ENVIRONMENT The park is uninhabited with the exception of the 10ha private enclave of the Hotel Il Guron. It is crossed by the busy road Ofenberg Zernez-Val Müstair, and in summer 5,000 cars can pass per day causing a number of road kills, especially at deer crossings. Constructions include guard posts and the Cluozza blockhaus. About 270,000 visitors a year use the park, but only on a network of official paths.

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Lake Manyara National Park

BIOGEOGRAPHICAL PROVINCE 3.05.04 (East African Woodand/savanna)

LEGAL PROTECTION Total. To the north and northeast of the park is the Mto wa Mbu Game Controlled Area, where licenced hunting is permitted. Southwest and contiguous to the park is the Marang Forest Reserve, in which no development is allowed.

DATE ESTABLISHED Given National Park status in 1960, having been a Game Reserve since 1957, and before then a Game Controlled Area. Declared a Biosphere Reserve in 1981.

GEOGRAPHICAL LOCATION In Arusha Region, 117km southwest of Arusha. 3°30'S, 35°60'E.

ALTITUDE 960-1478m

AREA 32,500ha, of which approximately one third is land, the remainder being part of Lake Manyara. The land area includes about 550ha added to the southern end in 1974.

LAND TENURE Government

PHYSICAL FEATURES The majority of the land area of the park is a narrow strip running between the Gregory Rift wall to the west and Lake Manyara, an alkaline or soda-lake, to the east. Most of the rift wall and in some places the edge of the plateau at its top are included in the park. The escarpment's face is dissected by spectacular gorges from which rivers, some flowing year round, feed into the lake, which is part of a closed drainage system. Porous volcanic rock occurs in the north, where perennial spring-fed rivers emerge from the escarpment base. The south is characterized by non-porous ancient crystalline rock. There are hot springs in the south where the rift wall comes close to the lake edge. Parts of the rift wall are gently sloping and covered in a network of animal trails, while elsewhere the face of the scarp is steep and rugged. Mean annual rainfall is 650mm, varying along the north-south axis of the park and occurring in two seasons, November-December and February-April. Rainfall variation results in marked changes in the level of the lake, which can be reduced to nearly nothing. Mean annual temperature is 22°C.

VEGETATION A complex mosaic of habitat types varies with topography. Below the rift wall, perennial springs in the north support a ground water forest, characterized by Trichelia roka, Croton macrostachyus, a fig Ficus sycamorus, and Tabernaemontana usambarensis, and edaphic grasslands of Cynodon dactylon. The tree species reappear in riverine habitats. At the edges of the ground water forest, yellow fever trees Acacia xanthophloea and the palm Phoenix reclinata form dense stands. A dense swamp of Typha angustifolia has reappeared at the northwest corner of the lake after being absent for many years. The central area of the park contains woodland of A. tortilis, A. sieberiana, and Balanites aegyptiaca. To the south, Capparis tomentosa, the sausage tree Kigelia africana, and perennial grasses are found. Along the western lake shore are alkaline grasslands characterized by Sporobolus spicatus. The escarpment face is characterized by perennial herb Ruellia megachlamys and is distinguished by baobab trees Adansonia digitata. Unlike the remainder of the park, the area above the rift wall on the plateau is subject to fires, restrained from moving east by the prevailing southeasterly wind. Here, fire-resistant grasses such as Themeda triandra are

characteristic. To the south on the plateau, the Marang Forest Reserve is a montane forest resembling the Ngorongoro Crater rim forest to the north; the Marang Forest vegetation is not known to have been studied.

FAUNA Manyara has what is possibly the greatest biomass density (weight per area) of mammals in the world. Elephant Loxodonta africana (T) (density 6/km) and buffalo Syncerus caffer (density 18/km) comprise the bulk of the biomass. Among visitors the park is well known for its lions Panthera leo which rest through the day several metres up in the branches of large trees (a habit which could be considered adaptive given the density of the above two species). Black rhinoceros Diceros bicornis (T) are still present, although no longer in the great numbers for which Manyara was known by hunters. Other significant species are hippopotamus Hippopotamus amphibius, impala Aepyceros melampus, giraffe Giraffa camelopardalis, and zebra Equus burchelli. Among other species are wildebeest Connochaetes taurinus, bushbuck Tragelaphus scriptus, leopard Panthera pardus (T), and baboon Papio anubis. In the dry season, large herds of wildebeest and other plains game from the Mto wa Mbu Game Controlled Area enter the park for short periods from the north. Manyara also has exceptional numbers of birds, in terms of both species (seen as of 1984) and populations. Spectacular flocks of water fowl are often present, sometimes breeding. Lesser flamingo Phoenicopterus minor can occur in thousands or millions and greater flamingo P. ruber in smaller numbers. White pelicans Pelecanus onocrotalus, yellow-billed storks Ibis ibis, and white-necked cormorants Phalacrocorax carbo are common. At least 44 species of diurnal birds of prey occur, including palm-nut vulture Gypohierax angolensis and Ayre's hawk eagle Hieraaetus dubius. Chestnut-banded sand plovers Charadrius venustus, common in the past, are now rarely sighted. The many reptiles include nile monitor lizard Varanus niloticus, often seen near rivers, and several species of cobra.

ZONING/CONSERVATION MANAGEMENT None No formal management plan exists, although draft versions have been made by several park wardens. A good relationship between park management and local inhabitants, including a network of informers, helps to keep poaching to a minimum; this is also aided by a high density of ranger patrols. Several techniques have been used to control the movement of animals from the park into contiguous agricultural land: an electric fence was in use along the northern boundary for several years in the 1960's, as was a heavy cable fence along the original southern boundary. Neither is now functional. Crop-raiding elephants and other species and cattle-killing lions are very occasionally shot by the authorities. Since 1970 plans have existed to increase the size of the park, for which approval was given in 1978. WWF/IUCN Project 1935 in 1980 gave funds towards the extension of the park to the south (for development of ranger posts, etc.). The Marang Forest Reserve (20,000ha), in the southwest, is now effectively part of the park. On a smaller scale, galvanized wire mesh wrapped around the trunk of the tree has been used with great effect to prevent elephants from debarking and thus hastening the death of mature Acacia tortilis, favored resting places for lions.

STAFF Senior park warden, one or two support wardens, administrator/accountant, and park assistant; total staff of 66 (1984).

LOCAL ADMINISTRATION Lake Manyara National Park, P.O. Box 12, Mto wa Mbu.

VISITOR FACILITIES Thanks to both its intrinsic appeal and its convenient location close to Arusha on the route tc Ngorongoro Crater and Serengeti National Park, Manyara has many visitors (28,000 pa). Accommodation varies from a hotel (100 beds) sited at the edge of the plateau above the rift wall

to several campsites near the main gate at the north end of the park. One of the campsites consists of small and simple self-contained cottages or bandas. A hostel at park headquarters is suitable for school parties. There is an airstrip outside the park near the hotel. A small museum is at the main gate. A good all-weather track runs the length of the park; several secondary tracks loop off the main route. Manyara has traditionally been accessed as a cul de sac from the north; the southern gate has recently been opened to encourage movement to and from Tarangire National Park in the southeast.

SCIENTIFIC RESEARCH AND FACILITIES The vegetation has been catalogued, described, and mapped by several researchers. A longitudinal ongoing study of the elephants began in 1966. The behavior and ecology of the buffalo was investigated from 1981-1985. (See references below). Housing for scientists may be found outside the park in the village of Mto wa Mbu and at the bandas. A very small research camp in the centre of the park, built and primarily used by the elephant research project, is under the administration of the Serengeti Wildlife Research Institute. A herbarium of the park is kept at the research camp. Scientists working at Manyara are affiliated with the Seronera Research Centre of the S.W.R.I.

MODIFICATION OF THE NATURAL ENVIRONMENT The park is too small to be viable. Current boundaries exclude substantial parts of the normal daily range of many of the large mammals, with profound consequences for both the park and those living nearby; elephants are chronic invaders of land are sometimes fatally speared in cultivated land bordering the park, which forms a buffer zone by definition only. Repeated major epidemics (1959: rinderpest-20% mortality buffalo; 1977: (unidentified)-15% mortality elephant; 1984: anthrax-90% mortality impala (same likely in 1965)) since the park was established demonstrate the critical need for allowing some movement of animals between Manyara and other reserves. The proposed extension of the park to the west (the plateau above the scarp) and to the south, and the proposed corridors from the northeast and southeast to Tarangire National Park would solve several problems at once, by including land regularly used by the resident population, incorporating higher rainfall areas that serve as critical refuges in times of drought, and by allowing for genetic flow. These new boundary lines have been mapped and plans exist for the administration of the enlarged areas and concomitant changes in current practice; for example, once the park is expanded ranger posts which are now only at the base of the escarpment can be shifted to the western boundary on the plateau, a far more effective location from which to patrol and to police the border. While the Marang Forest Reserve can be incorporated into the park easily as an exchange between government bodies, expanding the park to the south and west requires compensating and resettling displaced farmers. Funds are required for this. The park's vegetation and thus its fauna exist as they do in very large part because of rainfall outside the park to the west. Those drainage systems and catchment areas must be safeguarded for the sake of both the park and its agricultural and pastoral neighbours. Steadily increasing sand deposits from rivers is a sign of erosion outside the park. Integration of park and local planning is necessary if either is to succeed and to avoid the repetition of cases such as the ILO rice cultivation and irrigation project in the north that took place with no ecological impact study or liaison with the national park. In part due to the irrigation project, and for an array of other reasons, the human population around the park is steadily increasing. The electric fence in the north could be replaced by an effective low maintenance modern version. Illegal fishing in the park's waters is a problem, in part because poachers may use boats to gain access.

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Serengeti National Park

BIOGEOGRAPHICAL PROVINCE 3.05.04 (East African Woodland/savanna)

LEGAL PROTECTION Total

DATE ESTABLISHED Protected area since 1940. In 1929, 228,600ha of central Serengeti was declared a Game Reserve. National Park status in 1951 with extensive boundary modifications in 1959. Included with the adjoining Maswa Game Reserve as part of the Serengeti-Ngorongoro Biosphere Reserve in 1981. Accepted as part of a World Heritage Site in 1981.

GEOGRAPHICAL LOCATION West of Great Rift Valley, 130km west-north-west of Arusha. A corridor extends westwards to within 8km of Lake Victoria and a northern sector extending to the Kenya border. In the Mara, Arusha, and Shinyanga Regions. 1°30'-3°20'S, 34°00'-35°15'E.

ALTITUDE 920-1,850m

AREA The Biosphere Reserve covers 2,305,100ha and includes the Serengeti National Park (1,476,300ha); contiguous to the Ngorongoro Conservation Area (828,800ha) in the east, Maswa Game Reserve (220,000ha; recently reduced) in the south, Maasai-Mara National Reserve (167,200ha) in Kenya to the north, and Ikorongo Game Controlled Area on the west.

LAND TENURE Government

PHYSICAL FEATURES The plains of Serengeti are mainly crystalline rocks overlain by volcanic ash with numerous granitic rock outcrops (kopjes). In the north and along the western corridor are mountain ranges of mainly volcanic origin. Two rivers flowing west usually contain water and there are a number of lakes, marshes, and waterholes. Rainfall is mainly restricted to November-May with peaks in December and March/April. Mean annual temperature 20.8°C and mean annual precipitation 1210mm recorded at 1,150m.

VEGETATION The undulating open grassland plains are the major type of vegetation, but become almost desert during periods of severe drought. Dominant species are couch grass Digitaria macroblephara and Sporobolus marginatus (an indicator of saline soils). In wetter areas, sedges such as Kyllinga spp. take over. There is an extensive block of acacia woodland savanna in the centre, a more hilly and densely wooded zone covering most of the northern arm of the park, and some gallery forest. Lowland woodlands comprise Commiphora, Acacia drepanolobium, and A. gerrardii. Upland woodlands comprise Acacia lahai and A. seyal.

FAUNA The park is best known for the now unrivalled herd sizes of 'plains game', which migrate between seasonal water supplies. These include wildebeest Connochaetes taurinus (about 1.3 million), zebra Equus burchelli, Thomson's gazelle Gazella thomsoni, numerous prides of lion Panthera leo, and spotted hyena Crocuta crocuta. In May and June many game animals take part in a mass migration away from the central plains into the western corridor. Other characteristic mammals are hunting dog Lycaon pictus (T), leopard Panthera pardus (T), cheetah Acinonyx jubatus (T), elephant Loxodonta africana (T), black rhinoceros Diceros bicornis (T), hippopotamus Hippopotamus amphibius, giraffe Giraffa camelopardalis, buffalo Syncerus caffer, topi Damaliscus lunatus, waterbuck Kobus ellipsiprymnus, eland Taurotragus oryx, sitatunga Tragelaphus spekei, bushbuck T. scriptus, oryx Oryx gazella,

reedbuck Redunca redunca, mountain reedbuck R. fulvorufula, numerous species of rodents and bats, golden jackal Canis aureus, side striped jackal C. adustus, Grant's gazelle Gazella granti, seven species of mongoose, two species of otter, warthog Phacochoerus aethiopicus, and seven species of primate. Smaller predators include bat-eared fox Otocyon megalotis and ratel Mellivora capensis. Over 350 recorded bird species include 34 species of raptors, six vultures, kori bustard Choriotis kori, ostrich Struthio camelus and lesser flamingo Phoeniconaias minor, and several with a comparatively restricted distribution such as rufous-tailed weaver Histurgops ruficauda.

ZONING/CONSERVATION MANAGEMENT Three zones are proposed: strict nature reserve, tourist (or recreational) and defence. There are four administrative sub-divisions (anti-poaching zone): western, northern, Lobo, and Seronera lodges. Two tourist areas have been designated around Lobo and Seronera. Vehicles are not allowed off the tracks in a 16km radius from Seronera. Maswa Game Reserve forms an important buffer zone between the park and the populated region of Sukumaland. The management plan is under review, since the area was accepted as a World Heritage Site. The park administration works with the village authorities to resettle encroachers and re-mark the boundary. Grumeti Game Controlled Area has been incorporated in the park as greater control of the area was thought to be necessary. IUCN is coordinating on ambitious conservation and development programme in the Serengeti region in collaboration with NORAD. The overall aim of the programme and the most appropriate management for the whole area is to ensure that while the Serengeti remains as a wild ecosystem, local communities can benefit from appropriate development activities.

STAFF A staff of over 180 includes 35 in administration (many of whom trained at the College of African Wildlife Management at Mweka and/or the University of Dar es Salaam), 80 anti-poaching staff, one chief park warden and five park wardens.

LOCAL ADMINISTRATION Tanzania National Parks Authority, PO Box 3134, Arusha.

VISITOR FACILITIES Tourist facilities include lodges at Seronera and Lobo and four campsites near Seronera. Six access routes exist, but usually access is by road from the Ngorongoro Conservation Area. There are several airstrips and an aerodrome at Seronera. In 1983, after several years of isolation due to the closed border with Kenya, Serengeti recorded its lowest number of visitors (18,602) since the 1950s. The reopening of the Tanzania-Kenya border in December 1983 has already resulted in increased visitor numbers. If tourism increases further, a lodge may be built in the western Kirawira area.

SCIENTIFIC RESEARCH AND FACILITIES The park has been the centre for major research for the past 20 years, including studies in human and animal ecology, soils, vegetation, herbivores, predators, parasites, elephant damage, effects of burning and management problems and natural resource assessment. Present studies include continuation of long term studies of the behavioural ecology of lion, cheetah, dwarf mongoose and hyrax. An integrated research and management study of the effect of fire is in progress, as are studies of grazing ungulate behavioural ecology and banded mongoose behaviour. The Seronera Research Centre (formerly known as the Serengeti Research Institute) has well-equipped laboratories, a library, herbarium and accommodation for visiting scientists. Although not fully utilised while the Kenya-Tanzania was closed, the Centre is now fully utilised.

MODIFICATION OF THE NATURAL ENVIRONMENT Poaching in the southern, northern and western corridors seems to be increasing, while anti-poaching activities (and morale) are hampered by lack of fuel and equipment. At one time the

Serengeti was not within the elephants' range, but cultivation and settlement outside the park resulted in change in distribution. This resulted at one time in a number of problems. The combination of elephant, uncontrolled fires, and subsequent browsing and stunting of regrowth by giraffe has caused a decline in woodlands. There has also been some tree cutting in small areas on the west and north-west boundaries. Boundary markers (piles of stones) have been removed and cultivation begun.

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Sakaerat Environmental Research Station

BIOGEOGRAPHICAL PROVINCE 4.10.04 (Thailandian Monsoon Forest)

LEGAL PROTECTION Protected as a national forest reserve.

DATE ESTABLISHED Created a national forest reserve on 27 August 1972. Declared a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION Lies in the San Kamohaeng ranges, north-east of Khao Khieo mountains in Pak Thong Chai District, Nakhon Ratachasima Province. It is 240km from Bangkok on Highway 304 and 60km from Korat. 14°30'N, 101°55'E.

ALTITUDE 250-762m. The research station at 300m.

AREA 7,200ha

LAND TENURE Government

PHYSICAL FEATURES Sakaerat is on the north-eastern side of Khao Khieo which surrounds Korat Plateau. Drainage is into the Mae Khong River via the Mae Nam Mun. The tilted and slightly dissected plateau is of a great age with no evidence of major disturbances in the underlying strata. Streams are intermittent, but water persists locally throughout the six-month dry season. Observations on climate are available for the 1967-1974 period for eight stations. Annual rainfall is about 1200-1300mm, with less than 30mm in several months and a well-marked small dry season in July-August; maximum rainfall occurs in September and/or May.

VEGETATION The station encloses two main forest types: dry evergreen and dry dipterocarp. The principal tree species in dry evergreen forest are Hopea ferrea, Hydnocarpus illicifolius, Walsura trichostemon, and Memcylon spp., whereas dry dipterocarp forest is dominated by Shorea obtusa and Pentacme suavis. In addition, small areas of dry mixed deciduous forest with bamboo undergrowth occur on steep slopes and larger areas of Imperata spp. grasslands on abandoned fields.

FAUNA The fauna includes some 40 species of mammals, 103 species of bird, at least ten species of snakes, 11 species of lizards, seven species of amphibians and a wide variety of insects.

ZONING/CONSERVATION MANAGEMENT No core zone has been specifically delimited. The buffer zone corresponds to the area subjected to shifting cultivation on the lower slopes around the reserve. An area of 10ha has been set aside for offices and staff living quarters at the research station.

STAFF Fifteen permanent staff and 30 labourers. The deputy manager is also responsible for research.

LOCAL ADMINISTRATION c/o The Research Director, Environmental and Ecological Research Institute, The Applied Scientific Research Corporation of Thailand, 196 Phaholyothin Road, Bangkok 9.

VISITOR FACILITIES Visitors are not allowed.

SCIENTIFIC RESEARCH AND FACILITIES Numerous research projects have been conducted and include studies of micro-meteorology, flora and fauna, geology, and soil. A vegetation map is being prepared from 1975 aerial photographs and

a survey team is demarcating the official boundaries of the biosphere reserve. The research station is easily accessible by road from Bangkok. The headquarters is comfortable, supplied with running water and electricity, and can accommodate 30 persons. Meetings have been held, and researchers (national and foreigners) periodically visit the station.

LOCAL POPULATION In 1974, there were 103 families of squatters, numbering 652 persons, occupying a total area of 725ha.

MODIFICATION OF THE NATURAL ENVIRONMENT The area has been invaded by squatters for a long time. These people subsist by shifting cultivation growing mainly rice and maize.

PRINCIPAL REFERENCE MATERIAL
A list of five semi-annual reports and 29 scientific papers, prepared by the Applied Scientific Research Corporation of Thailand in 1967-1974, is available from the MAB Secretariat or from Sakaerat.

Hauy Tak Teak Reserve

BIOGEOGRAPHICAL PROVINCE 4.10.04 (Thailandian Monsoon Forest)

LEGAL PROTECTION Completely protected under the Forestry Act BE. 2484 (revised) and the National Forest Reserved Act BE. 2507.

DATE ESTABLISHED Declared a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Lies in the central portion of the Mae Ngao demonstration forest, 70km north of the Lampang Province. The highway from Lampang to Chiang Rai passes by the plantation. 100°00'E, 18°30'N.

ALTITUDE 290-1,200m

AREA 4,700ha

LAND TENURE Government

PHYSICAL FEATURES The topography is gentle. Geological strata range in age from Triassic to Carboniferous, including quartzite, slate phyllite and basalt. Mean daily temperature ranges from 22°C in January to 30.2°C in April; annual precipitation is 1228mm. The rainy season is from May to August.

VEGETATION The area was once a dry dipterocarp forest, with mixed deciduous stands of teak and dry evergreen, but now comprises pure stands of teak Tectonia grandis planted as from 1942.

FAUNA No information

ZONING/CONSERVATION MANAGEMENT The Hauy Tak Reserve has been divided into 4 sub-stations, namely Hauy Tak Plantation (over 2,362ha), Hauy Praw Plantation (over 224ha), Mae Yoark Plantation (over 1,088ha), and Sob Plerag Plantation (over 784ha). The sub-stations are connected by the national highway system which passes through the area.

STAFF Six foresters are assigned to work in the Hauy Tak Plantation.

LOCAL ADMINISTRATION Chief of Hauy Tak Teak Plantation, Amphur Ngao, Lampang.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The Hauy Tak Teak Plantation was established in 1942. Research is conducted to assess growth and yield of teak plantations. In 1965, a Teak Improvement Centre was established within the plantation, under a technical agreement between the Thai and Danish governments. An annual summer camp is also held for students from the Faculty of Forestry for training in plantation management.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve lies within the Mae Ngao demonstration forest, where various forest management strategies are being applied. The plantation of teak species is a major objective for the whole area, and a forest management plan has been adopted for the natural stand close to the reserve. Logging and other activities require Government permission. The area of natural forest close to the highway has been opened up by local farmers for growing crops, but land clearance is prohibited in the reserve area.

PRINCIPAL REFERENCE MATERIAL
Reports are available from the Faculty of Forestry, Kasetsart University, and scientists from the Royal Forest Department.

Mae Sa-Kog Ma Reserve

BIOGEOGRAPHICAL PROVINCE 4.10.04 (Thailandian Monsoon Forest)

LEGAL PROTECTION Most of the forest land has been declared a national forest reserve and is protected by forest laws, except for a lower portion set aside for military purposes. Extraction of timber harvesting is not allowed at present.

DATE ESTABLISHED Declared a Biosphere Reserve in January 1977.

GEOGRAPHICAL LOCATION Nam Mae Sa tributary of Mae Nam Ping, about 18km west of Chiangmai in northern Thailand. 18°49'-18°56'N , 98°47'-98°58'E.

ALTITUDE 310-1,660m

AREA 14,200ha. The reserve comprises two adjacent areas formerly known as Mae Sa Integrated Land Use Management Project and Kog Ma Watershed Reserve Station.

LAND TENURE About 1200ha of paddy in the valley is largely under private ownership, but some parts of the military reservation are leased to the farmers. Tribal people have illegally occupied about 1100 ha for swidden cultivation purposes. The forest land, which forms about 70% of the total area, is owned by the central government.

PHYSICAL FEATURES The area is a typical example of northern Thailand upland habitat. The terrain is rough with precipitous slopes in the western and southern parts of the basin. Geological formations include Quaternary

deposits in the flat plain at the eastern, lower end of the watershed, with Tertiary deposits along the margins of the plain. Most of the watershed is underlain by deeply weathered granites, with large blocks of gneiss and schist extending from the north-west corner down to the centre. The western ridges are limestone. The basin drains to the east via a 25km stretch of the Nam Mae Sa. There are eight perennial tributaries: three on the south side; four on the west; and one on the north. The climate is humid, with December to April being the dry season, and May to November the rainy season. Mean annual rainfall is 1900mm, with about 130 days of rain. The average relative humidity is 74% in the dry season and 90% in the rainy season. Mean annual temperature is 20°C, with a minimum of 17°C in October and a maximum of 25°C in May.

VEGETATION Mixed deciduous forest predominates, with dry dipterocarp forest and some 1200ha of mixed pine at lower altitudes and oak forest higher up.

FAUNA No information

ZONING/CONSERVATION MANAGEMENT The reserve has been zoned according to land uses.

STAFF Twenty (including training abroad)

LOCAL ADMINISTRATION Mae Sa Integrated Watershed and Forest Land Use Project, Box 1200, Chiangmai.

VISITOR FACILITIES There is a small park of about 70ha at the Mae Sa waterfall, with tourist facilities.

SCIENTIFIC RESEARCH AND FACILITIES Research on watershed management is being conducted. It includes studying the effects of introducing exotic crops and nut trees, improving the potential of grass and legume species for forest range utilization, surveying land and soil capabilities for land use reallocation, and investigating the hydrological regime of forests for improved water utilization.

MODIFICATION OF THE NATURAL ENVIRONMENT The poor standards of living and education among the hill farmers has aggravated the problem of forest destruction. Bad farming practices have resulted in increased run-off, leading to soil erosion and disrupted water regimes. Forest fires, mainly caused by man, are another increasingly serious source of disturbance. Since the beginning of the project's activities, these problems have been partly solved and damage minimized.

PRINCIPAL REFERENCE MATERIAL

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Parc national de Djebel Bou-Hedma

BIOGEOGRAPHICAL PROVINCE 2.28.11 (Atlas Steppe)

LEGAL PROTECTION Total

DATE ESTABLISHED The area was established as a protected forest in 1936 and part of it made a National Park in 1980. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION The Djebel Bou-Hedma National Park is in southern Tunisia, in the Orbata Bou-Hedma range of the south-eastern Sahara Atlas Mountains. It is situated 85km east of Gafsa, 25km south of Maknassy and 105km west of Sfax. The Sebkha en Noual lies 10km to the south. The Djebel Bou-Hedma is in the Gouvernorant of Sfax. 34°40'N, 09°38'E.

ALTITUDE 90-814m

AREA 11,625ha, of which 4,540ha are in the national park

LAND TENURE State government

PHYSICAL FEATURES The Djebel Bou-Hedma region is in the zone of Central Tunisia separating the Sahara continental shield from the Tunisian trench of the dorsal shield. The national park extends over the Djebel Bou-Hedma range and its southern foothills face the Sebkha en Noual. The Djebel Bou-Hedma is an eroded anticline, the two sides belonging to the middle Cretaceous period (marls and limestone) and the central basin formed during the Jurassic and early Cretaceous period (gypsum and salt marls). The foothills consists of detrital deposits from the Quaternary period on the sides of the Djebel. These deposits were embedded in limestone and gypsum during this same period. Towards the bottom these formations give way to gypsum and salt alluvium from the Sebkha en Noual. The region falls within the arid belt. The mediterranean climate causes temperate winters, north of the Djebel Bou-Hedma range; cold winters, occur to the south, influenced by the continental climate of the steppe-like plains of Gafsa and the Sahara. The average annual rainfall is 195mm. The average maximum temperature of the hottest month is 38.1°C and the average minimum temperature of the coldest month is 3.9°C.

VEGETATION The national park was primarily set up to safeguard the relict Acacia raddiana forest. The Djebel Bou-Hedma, with sub-tropical savanna of Acacia raddiana, Cenchrus ciliaris, Digitaria nodosa, Aristida plumosa and A. obtusa, represents a unique relict of an old pre-Saharan savanna similar to the present peri-Saharan vegetation of the African Sahel. The Maknassy plain and foothills of the Djebel Bou-Hedma are a steppe with Rhantherium suaveolens, alfa-grass facies; the northern slope of the Djebel Bou-Hedma is a steppe resulting from the deterioration of a juniper forest; the southern foothills are an Acacia raddiana forest, with Artemisia herba alba and Arthrophytum scoparium steppes, gradually changing into a Gymnocarpus decander and Stipa tenacissima steppe. Towards the Sebkha en Noual the vegetation is saline sub-azonal.

FAUNA The fauna is characteristic Saharan and peri-Saharan. In the Orbata-Bou-Hedma range the following species are found: barbary sheep Ammotragus lervia, gundi Ctenodactylus gundi, North-African elephant shrew Elephantulus rozeti, sand cat Felis margarita and Saharan striped weasel Poecilictis libyca. In the foothills and the plains: Dorcas gazelle Gazella dorcas, fennec fox Fennecus zerda, fat sand rat Psammomys obesus, Libyan jird

Meriones libycus, lesser Egyptian jerboa Jaculus jaculus, Varanus griseus, the snakes Vipera lebetina deserti and Naja haje, Tarentola mauritanica (Gekkonidae), Uromastix acanthinurus (Agamidae), Echis carinatus, Cerastes cerastes (Viperidae), Chalcides ocellatus, Scincus scincus (Scincidae), Psammodromus algirus nolli (Lacertidae), Testudo graeca (Chelonian), Coluber hippocrepis (Colubridae) and Chamaeleo chamaeleon. Reptiles characteristic of halophilous vegetation include Stenodactylus stenodactylus (Gekkonidae), Eremias olivieri, Acanthodactylus baskianus (Lacertidae); while the springs support the amphibians Rana ridibunda, Bufo mauritanicus and B. viridis. Particularly noteworthy among the birds are: houbara bustard Chlamydotis undulata, golden eagle Aquila chrysaetos, Bonelli's eagle Hieraaetus fasciatus, magpie Pica pica mauretanica, spotted sandgrouse Pterocles senegallus and fulvous chatterer Turdoides fulvous. Details of reptiles and amphibians are given in Blanc and Snane (1981).

CULTURAL HERITAGE The acacias may not be natural, but instead, planted by the 'Limitanei' of the Roman empire who colonised the area between the third and sixth centuries.

ZONING/CONSERVATION MANAGEMENT The National Park is a core area of 4,540ha. The core area, which corresponds to the national park, is delimited by a fence and trench, and the difference caused by excluding domestic stock is obvious, the park having much more grass. There is a programme of replanting acacias which is fairly successful. Some local people are being used for work in the park.

STAFF The Forestry Department of Sidi-Bouzid is responsible for the supervision and conservation of the Djebel Bou-Hedma Park. A forester and seven rangers are employed in the park.

LOCAL ADMINISTRATION Ministère de l'Agriculture, Direction des Forêts, 30 rue Alain Savary, Tunis, Tunisia.

VISITOR FACILITIES There are practically no tourists and no facilities; the road to the park is not good. Accommodation is available some distance away in Sfax.

SCIENTIFIC RESEARCH AND FACILITIES Research in the Bou-Hedma region has been chiefly concerned with reafforestation to re-establish the forest of Acacia raddiana gum trees and so restore the original character of this region and half the advance of the desert. The Research Institute at Gabès has carried out phytosociological studies, investigating the relationships between soil, water content, temperatures grazing and vegetation. Much more research is needed, particularly on the effects of grazing of wild animals.

LOCAL POPULATION The buffer zone is fairly densely populated, mainly by pastoralists and grazing pressure is heavy.

MODIFICATION OF THE NATURAL ENVIRONMENT Grazing pressure is a problem; the national park was scheduled to include 16,000ha but would have been impossible to establish at this size. The Acacia raddiana forest used to cover about 40,000ha in this area but has been reduced to 10ha, in the park. Anthropogenous species have replaced natural ones, including Peganum harmala, Cynodon dactylon and Bassia murita. Large mammals are fewer in the north where the human population is higher. More scientific interest, particularly from overseas, would be advantageous. However, there is no overnight accommodation, the road needs improving and there are no visitors' facilities. Around the core area, the local population is attempting to

reduce wind erosion by planting and increase productivity so that it will be difficult to expand the core.

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Parc national de Djebel Chambi

BIOGEOGRAPHICAL PROVINCE 2.28.11 (Atlas Steppe)

LEGAL PROTECTION Total

DATE ESTABLISHED The National Park was set up in 1980 under legislation given in the Forestry Code, 1967. It was accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION It lies 15km east of Kasserine, 35km north of Feriana, and 50km south of Thala in the Gouvernorat of Kasserina. 35°13'N, 8°43'E.

ALTITUDE 700-1,544m

AREA 6,000ha

LAND TENURE State government

PHYSICAL FEATURES The park is situated in the Djebel Serdj Zaghouan chain and includes the highest mountains in Tunisia. The mountains are part of a series of anticlines composed mainly of Cretaceous rocks, with some Tithonian formations. There are also flatter plains in the reserve. The climate is continental with most rain in spring and winter and a few days of snow usually occur. Annual precipitation is about 350mm. The average annual temperature is 15.8°C, ranging from a mean in January of 1.8°C to a mean in July of 34.4°C.

VEGETATION The park has a series of vegetation unique in Tunisia. In the mountainous parts are holm oak Quercus ilex, and Stipa fontanesii, S. senecia, Sorbus aria, Cotoneaster nummularia, Rosa sicula, Delphinium balansae, Senecio gallarandianus, S. cinerea and Campanula atlantica. It passes through pine forest of Pinus halepensis with holm oak, juniper Juniperus oxycedrus and J. phoenicea to esparto grassland Stipa tenacissima on the steppes.

FAUNA This region is the last refuge for the idmi or Cuvier's gazelle Gazella cuvieri (E), about 200 of them living between the Djebel and the Algerian frontier. Other mammals include crested porcupine Hystrix cristata, striped hyena Hyaena hyaena, Egyptian mongoose Herpestes ichneumon and wild cat Felis silvestris. There are a number of birds of prey, including Bonelli's eagle Hieraeetus fasciatus, booted eagle H. pennatus, golden eagle Aquila chrysaetos, peregrine Falco peregrinus and common kestrel F. tinnunculus.

ZONING/CONSERVATION MANAGEMENT Hunting, forestry and grazing are prohibited. A development plan is being prepared to aid management.

STAFF Maintenance and supervision are provided by the staff of the Kasserine Forest District. Permanent guards are assigned to the park.

LOCAL ADMINISTRATION Ministère de l'Agriculture, Direction des Forêts, 30 rue Alain Savary, Tunis.

SCIENTIFIC RESEARCH AND FACILITIES Ecological and floristic research has been done on the Djebel Chambi vegetation, and geological studies made. The massif is accessible by tracks which can be used by motor vehicles.

LOCAL POPULATION The local population is mainly involved in agriculture, and nomadic people live in the park.

MODIFICATION OF THE NATURAL ENVIRONMENT At the foot of the mountains, overgrazing and timber extraction have led to soil erosion through removal of the protective vegetation. In the higher forested areas, fires have affected the forest and soils. There are a number of cultivated enclaves but these are uninhabited.

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Parc national de l'Ichkeul

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED January 1977 as a Biosphere Reserve. June 1980 listed as a Ramsar Site. September 1980 as a World Heritage Site. Classified as a National Park 18 December 1980 (Decree No 80-1608, gazetted in the J.O.R.T. No 77).

GEOGRAPHICAL LOCATION In north-east Tunisia, on the Mateur plain, 25km south-west of Bizerta and 15km north of Mateur (Bizerta District). 37°10'N, 09°40'E.

ALTITUDE -2m

AREA 10,770ha

LAND TENURE The lake and Djebel are government property. The marshland is privately owned.

PHYSICAL FEATURES The park includes Lake Ichkeul, the largest area of freshwater in the country which covers 8,700ha in summer; about 770ha of marshland; and Djebel Ichkeul, an isolated massif between the marshes and lake which was an island in Roman times. The lake's salinity and level varies on an annual cycle. From October to May it is fed by six oueds but in summer the lake's level falls and salinity increases due to high evaporation rates and inflow of water from the sea for four months via Bizerte Lake and Tindja oued, which makes the north-east of the lake particularly saline. The lake and marsh are underlain by Quaternary alluvium but Djebel Ichkeul is composed of Triassic and Jurassic dolomitic limestone which has been metamorphosed to form marble and contains many fossils. The minimum mean monthly temperature in January is 11.3°C and the maximum mean monthly temperature in July is 25.2°C with an absolute minimum of 0°C in winter and absolute maximum of 48°C in summer. Average annual rainfall is 625mm distributed over 113 days, only 4% falling in the summer period. Between 250 and 400 million cubic metres of rainwater pour into the lake each year, and 10 to 30 million of sea water.

VEGETATION Up to a third of the lake's area, particularly in the west, is covered with fennel-leaved pondweed Pontamogeton pectinatus. The marshes are dominated by the bulrush Scirpus maritimus, together with S. lacustris, Juncus sublatus and Zannichellia palustria. The zoning of the aquatic vegetation is complex and varies from year to year, related to lake levels and salinity. Reeds Phragmites communis fringe the lake and glasswort Salicornia arabica and seablite Suaeda sp. cover the most saline areas. Higher, well drained ridges are dominated by Hordeum maritimum with Lolium multiflorum and Dancus carota or Nerium oleander and Zizyphus lotus. Ranunculus ophioglossum, recorded at only a few sites in Tunisia, also grows in the marshes. The Djebel is covered with a grouping of olives Olea europaea, Pistacia lentiscus and Similax aspera, varying from fairly dense pure olive groves to associations in which other species co-dominate, especially Euphorbia dendroides on the south-east slopes and Juniperus phoenicea on the northern slopes. The Djebel has a rich variety of northern Tunisian plant species including Teucrium shoenenbergeri, a species endemic to Tunisia, Nothotena vellea, Ceratonia siliqua, Crypsis aculeata and Tetroclinis articulata.

FAUNA Ichkeul is the most important site in North Africa for wintering and migrant waterbirds, with 300,000-400,000 passing through. Almost all the European population of greylag geese Anser anser winter here (20,000) as do vast numbers of coot Fulica atra (70,000 with a maximum of 400,000) (Hollis, 1986). There are lesser numbers of wigeon Anas penelope (30,000-50,000, with a maximum of 110,000), teal A. crecca (11,000), shoveler A. clypeata (5,000) and pochard Aythya ferina (50,000-75,000, maximum 120,000) (Hollis and Wood, 1982). The lake may also be the most important area west of the Caspian Sea for the resident white-headed duck Oxyura leucocephala (over 600; Hollis, Wood and Warren, 1980). Many waders and herons pass through on autumn and spring migration, including great white egret Egretta alba, glossy ibis Plegadis falcinellus, black stork Ciconia nigra, greater flamingo Phoenicopterus ruber and black-winged stilt Himantopus himantopus. Nesting birds are few and most prefer the Djebel, including booted eagle Hieraeetus pennatus, Bonelli's eagle H. fasciatus, Egyptian vulture Neophron percnopterus and the rare Moussier's redstart Phoenicurus moussieri. Over 185 bird species have been recorded. The otter Lutra lutra is occasionally found on the shores of the lake and stable populations of the following mammals have been reported: crested porcupine Hystrix cristata, mongoose Herpestes ichneumon, wild cat Felis sylvestris lybica and small-spotted genet Genetta genetta. The Ichkeul water

buffalo, Bubalis bubalis, is being reintroduced into the marshes, there being no wild buffalo in Tunisia at the present time. The invertebrate fauna is typical of brackish water areas, including Nereis diversicolor, Gammarus locusta, G. aequidcauda, Corophium volutator, Sphaeroma hookeri, Idotea spp., Hydrobia spp., Abra spp. and Cerastoderma glaucum. Carcinus mediterraneus and Balanus amphitrite occur in the west near the Tindja canal and freshwater species on the edge of the marshes. The dense Potamogeton beds contain the most abundant animal populations in the lake. The principal fish species are eel Anguilla anguilla, mullets Mugil cephalus and M. ramada, bass Dicentrarchus labrax, barbel Barbus barbus, sole Solea solea and Twaite shad Alosa falla. There are currently only small populations of tooth-carp Aphanius fasciatus and Sygnathus sp.. The frog Rana ridibunda is abundant in the lake and Clemys leprosa can be found in the marsh.

CULTURAL HERITAGE Some hot springs within the park are believed by the local people to cure rheumatism.

ZONING/CONSERVATION MANAGEMENT There is a buffer zone of an additional 6,000ha. There has been much research into how best to manage the lake now that dams have been built on several streams which formerly supplied fresh water. The University of London (UCL) has been contracted to investigate this and produced computer models of the water and salinity balances (Warren et al., 1970). The most urgent management objectives are the building of a sluice on the Oued Tindja and infilling of a drainage canal on the Djoumine marsh (Hollis, 1986). Other plans include possibilities of reducing the area of freshwater lake to cut down evaporation (Hollis et al., 1985). These are related to the main objectives of controlling sediment infill of the lake and maintenance of Potomageton and other vegetation types which are important food sources for birds. The EEC was funding a four-year management study by UCL, the International Wildfowl Research Bureau and French scientists from 1981-85.

STAFF No information

LOCAL ADMINISTRATION Ministère de l'Agriculture, Direction des Forêts, 30 rue Alain Savary, Tunis, Tunisia.

VISITOR FACILITIES The number of visitors in 1981 was small, but steadily growing, mainly consisting of ornithologists. There are well-developed tourist facilities in Tunisia and Tunis is only 50km away. There is a visitor centre and WWF was supplying $37,400 for equipment in 1986-87. The hot springs, believed to have curative powers, are an attraction.

SCIENTIFIC RESEARCH AND FACILITIES Studies of the biological environment of Lake Ichkeul have been made by the University of Tunis and the Salambo Oceanographic Institute. Palaeontological excavations in 1947, 1948 and 1949 made it possible to study the Villafranchian (Calabrian) stratum of the lake and bring to the surface mammal fossils of that are rare in North Africa. Stratigraphical and palaeontological studies were carried out by the Tunisian National Bureau of Mines. A phytoecological map of the region has been produced. An observation and counting programme of waterfowl is under way with the collaboration of International Wildfowl Research Bureau (IWRB) and the Tour de Valat Biological Station (France).

LOCAL POPULATION About 100 families live in the periphery of the park and are allowed to graze livestock on the marshes to some extent. Hot springs, within the park, are believed by the local people to cure rheumatism.

MODIFICATION OF THE NATURAL ENVIRONMENT This part of Tunisia is one of the most important for water supply in the country, which is generally very arid but has increasing demands for water, including from its thriving tourist industry. Locally, around the lake, there is pressure for land and water to irrigate it. Dams have been built on the Djoumine and Rhezla rivers, reducing the lake's supply of fresh water and upsetting water and salinity levels. The vegetation composition has been altered by this: the area of Potomageton on which many bird species feed was greatly reduced in 1986 due to high salinities; Scirpus maritimus is being replaced in many places by Ammi visnaga and Scolimus maculatus (Hollis, 1986). The construction of a sluice on the Oued Tindja to control seawater inflow and contain fresh water will not be an entirely satisfactory solution as it will increase summer evaporation and hence salinity in some areas, reducing the Potomageton area and affecting many bird species' numbers. The tenders received for the sluice in 1986 were too expensive and this might delay its construction until 1988-89. A drainage canal on the Djoumine marsh has still not been filled in and there are plans to build a large dam on the Sedjuane river. The lake has been silting up since Roman times, partly due to over-clearance of vegetation from hillsides. Overgrazing by domestic cattle on the marshes has probably led to death by malnutrition of the reintroduced water buffalo. Some illegal ploughing of 5ha of the marshes was recently stopped, and resettlement of some of the local population is planned. Marble quarries on the Djebel are still expanding.

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Parc national des Iles Zembra et Zembretta

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION Total

DATE ESTABLISHED The Reserve was established in 1973 under Ministry of Agriculture Decree and accepted in January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION The islands are situated in in the Gulf of Tunis, 10km from the mainland, the nearest point being Ras el Ahmar, on the Cap Bon peninsula. The islands are in the Gouvernorat of Nabeu. 37°06'N, 10°48'E.

ALTITUDE -50m to 433m

AREA Total area 4,030ha; Zembra Island: 389ha; Zembretta Island: 2ha; marine zone: 3,639ha.

LAND TENURE State government

PHYSICAL FEATURES Zembra island is triangular in shape and composed of alternating strata of limestone and clay, the usual Oligocene facies found in northern Tunisia. At its northern point the cliffs are 200m high while the highest point rises to 433m. The topography is fairly rugged and drained by a oued, or temporary river, which flows to the south coast. Zembretta is a trapezoidal sandstone rock about 400m by 50m. The islands are in the paths of the Atlantic current, flowing from western waters. The climate is sub-humid mediterranean with mild winters and strong winds. The average annual temperature is 18°C, the coldest month having a mean 8.3°C, the warmest 31.9°C.

VEGETATION The original shrub vegetation of pistachio Pistacia lentiscus and olive Olea europaea has been degraded. The vegetation on Zembra island consists of species found in Sicily, the Tunisian mainland, Khroumirie, the Oran region and countries situated even further west. Species or varieties from Greece and the east have also been found. Some 230 species have been recorded. The maquis consists of Pistacia lentiscus, Olea europaea, Erica arborea and Calycotome villosa, with several rare species: Iberis semperflorens, Dianthus hermaensis, Brassica creticara atlantica and Poterium spinosum. The marine flora consists mainly of 14 species of red algae (Rhodophyceae), including Phyllophora nervosa and Chondrus crispus. There are also five species of brown algae (Phaeophyceae), including Laminaria rodriguezii and Dichtyota dichotoma, and eight species of green seaweeds, including Udotea petiolata and Caulerpa prolifera.

FAUNA The wild rabbit Oryctolagus cuniculus, which is not found on the African mainland, is found on Zembra and Zembretta Islands. Zembra Island affords shelter to the monk seal Monachus monachus; a report in 1980 stated that 25 pairs had been "recently reported". The waters near the coast are often frequented by common dolphin Delphinus delphis. The peregrine falcon Falco peregrinus also nests (ten pairs). The marine fauna is very rich, consisting mainly of Mollusca (56 species), Echinodermata (21 species) and fish (21 species). Epinephelus aenus, Morone labrax, Scyllarides latus and many species of Sparidae are a feature of the Zembra region. The Atlantic current has an important influence on the marine fauna, transporting larvae from further west.

CULTURAL HERITAGE The islands were inhabitated in Roman times.

ZONING/CONSERVATION MANAGEMENT The islands are generally strictly protected, inlcuding waters up to a distance of a mile and a half from them. Some use is allowed for educational tourism.

STAFF The Nabeul Forestry Department is responsible for the supervision and maintenance of Zembra Island. Two rangers are posted there permanently.

LOCAL ADMINISTRATION Ministère de l'Agriculture, Direction des Forêts, 30 rue Alain Savary, Tunis, Tunisia.

VISITOR FACILITIES In the south-west bay on Zembra island there is a jetty and a bungalow-style hotel which opens in summer for courses in diving and underwater photography. A daily ferry service operates during this period from Cap Bon.

SCIENTIFIC RESEARCH AND FACILITIES Various studies have been undertaken on the scientific uses of Zembra Island. An inventory of the flora and the ornithological fauna, and studies in parasitology have been made. Zembra Island should be a periodical observatory for hydrological, ecological and systematic surveys, as well as for observing seasonal variations in the Atlantic current and following the development of plant and animal populations. In summer there is accommodation available and a daily boat service between Sidi-Daoud, Cap Bon and the port of Zembra, but boats have difficulty in mooring in winter, because of rough seas.

LOCAL POPULATION The islands have no permanent residents, apart from two rangers.

MODIFICATION OF THE NATURAL ENVIRONMENT Zembra Island was once covered by a shrub community made up of Olea europaea and Pistacia lentiscus. Grafting of olives and a certain amount of clearing probably began in the Roman period. The present deforestation is undoubtedly more recent and results from cutting, intensive grazing and fires. The climax has consequently given way to a relatively degenerate maquis of Cistus and heathers. The island is uninhabited. A few paths enable one to move about. A bungalow-style hotel and a landing jetty have been built in the southwest bay. In the summer, this hotel is open for scientific tourism, when courses are given in diving and undersea photography.

PRINCIPAL REFERENCE MATERIAL

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Queen Elizabeth (Rwenzori) National Park

BIOGEOGRAPHICAL PROVINCE 3.05.04/3.20.12 (East African Woodland/savanna and (Central African Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED April 1952 as Queen Elizabeth National Park (197,800ha); the area was known as Rwenzori National Park between 1972 and 1980. Accepted as a Biosphere Reserve in November 1979.

GEOGRAPHICAL LOCATION Situated on both sides of the Equator in western Uganda on the Zaire border, between Lakes Edward and George. 0°15'S-0°10'N, 29°45'-30°05'E.

ALTITUDE 910-1390m

AREA National Park 197,800ha and Biosphere Reserve 220,000ha. Contiguous to Kigezi Game Reserve (32,830ha), Kyambura Game Reserve (15,700ha), and Kibale Forest Corridor Game Reserve (33,910ha) in Uganda and Virunga National Park (809,000ha) in Zaire. Kazinga Channel Sanctuary (20,700ha) abuts the east central boundary and part of the southern shore of Lake George.

LAND TENURE Government

PHYSICAL FEATURES The park is situated in the western Rift Valley between Lake George and Lake Edward. The lakes are joined by the 34km-long Kazinga Channel, which bisects the park. Mean annual rainfall is 700mm with marked differences occuring over short distances, falling mainly during two rainy seasons in March to May and August to November. This area was one of volcanic activity 8,000 to 10,000 years ago and to the north of Lake Edward there is an area of explosion craters, some containing salt lakes. The eastern boundary of part of the park follows the escarpment of the rift valley edge. There are areas of swamp, the largest being in the north, to the north of Lake George, and much of the park is fairly flat. Climate is cool for the latitude; temperatures are similar all year round. Mean minima are about 18°C and maxima 28°C most months, but rain falls mainly in two seasons, March to May and September to November. It varies considerably within the park, increasing from about 750mm annually on Lake Edward, towards the escarpment, which has about 1230mm per year.

VEGETATION The area has a remarkable range of ecosystems: semi-deciduous tropical high forest, undulating grasslands, Acacia savannas, swamps and tundra. Maramagambo Forest (about 50,000ha) is between the escarpment and Lake Edward and comprises a wide belt of medium altitude semi-deciduous forest. It is the only forest of any extent protected within an Ugandan National Park. South of this forest are the rolling plains of the Kigezi section, and north are grasslands dotted with Euphorbia spp.. The bush cover appears to have increased over the past few years with the decline in elephant numbers.

FAUNA A west African influence is apparent in the fauna, particularly among birds and invertebrates. The park is well-known for its rich and diverse tropical fauna with large herds of buffalo Syncerus caffer (4200 in 1980), elephant Loxodonta africana (T) (153 in 1980), and hippopotamus Hippopotamus amphibius. A 1980 survey recorded five elephant herds totalling about 150 animals (though this is regarded as an under-estimate) though numbers have been greatly reduced by poaching compared with previous years. Other large

mammals include: kob Kobus kob (most numerous species: about 20,000), waterbuck K. ellipsiprymnus, bushbuck Tragelaphus scriptus, warthog Phacochoerus aethiopicus, topi Damaliscus lunatus, and leopard Panthera pardus (T) also interesting species are chimpanzee and giant forest hog Hylochoerus meinertzhageni. There are some surprising gaps in the fauna, such as the absence of zebra and impala. The Kigezi section is well-known for tree climbing lion Panthera leo. There are 543 recorded bird species including: shoebill Balaeniceps rex (of special concern), black bee-eater Merops gularis, 11 species of kingfisher including malachite Alcedo cristata and pied Ceryle rudis, and numerous resident and migrant (Palaearctic and African) raptors such as Peregrine falcon Falco peregrinus, bateleur Terathopius ecaudatus, migrant black kite Milvus migrans parasitus, and Wahlberg's eagle Aquila wahlbergi. Nile monitor Varanus niloticus is common along the Kazinga channel.

ZONING/CONSERVATION MANAGEMENT Improvements in anti-poaching methods had been implemented, but more recently staff have been disarmed and their vehicles requisitioned, and this has led to increases in poaching. There is a management plan.

STAFF Some 107 rangers with 55 at park headquarters, and 52 in 13 outposts. They did spend about two-thirds of their time on patrol with about 60% of the park covered each month, but during the recent troubles travel has been curtailed following the requisition of park vehicles.

LOCAL ADMINISTRATION Park headquarters is situated at Mweya.

VISITOR FACILITIES Mweya Lodge, run by Uganda Hotels, is fully operational. There are two hostels and self-catering bandas at Ishasha in the south of the park. A campsite is available on the Mweya Peninsula and elsewhere within the park. Launch trips are organised along the Kazinga channel. Uganda Airways run a regular service from Entebbe to Kasese, 40km from Park Headquarters.

SCIENTIFIC RESEARCH AND FACILITIES Research at the Uganda Institute of Ecology continues, including studies on overgrazing by goats and habitat exploitation by bushbuck. At present, there is a study on the effects of fishing villages on the park's animals. The park contains the oldest ecological research station in East Africa (Uganda Institute of Ecology) with five permanent research workers. Research facilities were partly destroyed during the recent political unrest. There are no educational facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT The higher areas are in a natural state, but there are about 20 settlements in the lower area on the lakeshore. The population has increased recently (due in particular to a salt factory built with German aid, but which is no longer functioning and has been abandoned), and is putting great pressure on natural resources. There has been an increase in fire, grazing (sheep, goats and cattle), and overfishing of the lakes. All game species, except kob, were still declining in numbers in 1980. Staff are currently without weapons or vehicles, though they remain within the park.

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Chernomorskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.29.11 (Pontian Steppe)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established by decision of the Soviet of the People's Commissors of the Ukrainian SSR on 14 July 1972 No. 172. The Soviet of Ministers of the Ukrainian SSR decided in 1976 to designate the Yagorlytskiy and Tendrovskie bays (of the Black Sea) as Ramsar sites. The reserve was accepted for biosphere status in 1984.

GEOGRAPHICAL LOCATION The reserve is located in the south-western part of the Ukrainian SSR (in north-western Pre Black Sea region) and consists of four units to the south of the river Dnepr between the Dnepro-Bugskim estuary and the Karkinstskim Bay of the Black Sea. It is situated in the Chersonski and Nikolaevski administrative regions with central administration for sections Ivano-Pybal'chanski, Solenoozernyy, Yagorlytskiy Kut and Potievka at Kherson and for section Volyzhin Les at Nikolaev. 46°12'N, 32°00'E.

ALTITUDE 0-100m

AREA Total area of 87.348ha consisting of 9,448ha terrestrial and 77,900ha aquatic. Within the buffer zone there is the Yagorlytski state Ornithological Zakaznik covering an area of 30,300ha. The land areas are divided up between Ivano-Rybal'chanskiy (3,104ha), Solenoozernyy (2,293ha), Volyzhin Les (203ha), Yagorlytskiy Kut (875ha), Potievka (1,155ha), Tendra Island (1,289ha), Dolgiy and Kruglyy Island (478ha) and five smaller islands - Babin, Orlov, Smalenyy, Konskie and Sibirskiy - totalling 69ha. The biosphere reserved consists of four sections, are large unit and three smaller ones.

LAND TENURE State owned

PHYSICAL FEATURES The parts of the reserve located in the lower Dnepr section of the Prechernomorsko-Preazovskoy regions consist of dry steppes within the steppe zone. The lower lying widely scattered sandy hillocks of the lower Dnepr are characteristically covered with trees and grasses typical of more northern zones. The climate is dry with a mean rainfall of about 325mm, and July temperature of 20°C with 180-120 days annually without frost.

VEGETATION The flora and vegetation of the reserve is charactersitic of the northern Prechernomor'ya steppes. The habitats present are classified as dry sandy steppes, forests, fresh water and saltwater marshes and offshore and salt sprayed islands. Of 595 species of flora recorded twenty-one species of rare and endangered plants present appear in the USSR and Ukrainian Red Data Books. Amongst these there are Elytrigia stipifolia and Centaurea taliewii as well as endemics. In total 11 plant complexes have been identified: 1) sandy steppes with endemics: C. breviceps, Goniolimon graminifolium, Lurinea laxa, and Tragopogon borysthenicus; 2) stony steppes with endemics Dianthus platyodon, Senecio borysthenicus and Onosma borysthenicum; 3) wooded groves, the remnants of previous woodlands of oak, bird, alder and aspen with endemics Betula borysthenica, Crataegus helenolae and C. alutacea; 4) sandy meadows with endemics Festuca laeviuscula, Genista borysthenica and Agrostis subulicola; 5) freshwater marshes; 6) salt marshes; 7) salt steppes on brown earth soils; 8) salt steppe and salt marsh complexes; 9) salt marsh complex on the flora of bays and seashores; 10) sandy-littoral; 11) sandy-shell steppes on Black Sea islands;

FAUNA Species typical of water-swamp complexes and the steppes of northern Prechernomor'ya are present. Records exist for 45 species of mammals, 300 species of birds (145 breeding, 52 on passage, 70 wintering and 33 irregularly) nine species of reptiles, four species of amphibians, 60 species of fish and approximately 4000 species of invertebrates. Of the mammal species listed in the USSR and Ukrainian Red Data Books, the reserves holds Neomys anomalus, Nyctalus leisleri, Nyctalus lasiopterus, Vormela peregusna, Mustella everesmanni, Scirtopoda telum, Spalax arenarius. Birds inlude Otis tarda, Anthropoides virgo, Haliaeetus albicilla and Falco cherrug. Other species include Elaphe quatuorlineata and Vipera ursini renardi. Many waterbirds have a high population, whilst the entomological fauna has components of European-Siberian groups, boreal, steppe and mediterranean groups.

ZONING/CONSERVATION MANAGEMENT The reserve includes Yagorlytski and Tendrovski bays with their numerous islands and consists of seven core zones surrounded by a buffer zone and a further protective belt. The core zones with strict protection include all the islands, the lake shores of the Solenoozerni and Potievski sections, the Yagorlytski Kuta, the interior sections of the Iuano-Rybal'chanski with the central section of the Tendra island and certain central sections of the Volyzhin Les. The Yagorlytskiy State ornithological zakazniki acts as the buffer zone. Additionally there is a one kilometre protective belt surrounding all parts of the reserve, whether they are terrestrial or aquatic and covering 11,011ha. The reserve is governed by a strict protection regime and the protective belts covering a total of 11,011ha have a policy of regulated economic activity. In accord with All-Union and Republican laws, all activities which are likely to disturb or threaten the natural communities and objects are prohibited on the territory of the reserve as well as in the buffer and protective zones. The reserve is managed by the Ukrainian Academy of Sciences.

STAFF Fifty-seven people

LOCAL ADMINISTRATION Ul. Lermontova 1, Golaya Pristan', Khersonskaya region, Ukraine SSR 326240.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The only legitimate use of the reserve is for scientific research, which includes studies on the nature of sandy steppes, woodlands and fresh and brackish waters of the northern Prechernomor'ya. Research is also conducted on the structure of the contact zone between the steppe and the sea, on the seasonal and yearly fluctuations in breeding and migratory birds as well as a mass ringing programme.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve is situated in a region of intensive agriculture, fishing and near to the construction sites for the Dunay-Dnepr hydro complex and as such maybe regarded as an important environmental control and monitoring site.

PRINCIPAL REFERENCE MATERIAL

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Askaniya-Nova Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.29.11 (Pontian Steppe)

LEGAL PROTECTION Total protection afforded to zapovednik area.

DATE ESTABLISHED The first 'partially' protected reserve in Russia created in 1878 (for the acclimatization of domesticated stock) and declared a reserve in 1921 with its present boundaries established in 1956. It was approved as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION It is located in the southern Ukraine in the south-eastern part of the Prichernomorsky lowlands in the Chaplinski rayon of the Khersonski Oblast', 25km north of the Sivash lagoon and 50km south-east of Novaya Kakhovka. 46°28'N, 33°55'E.

ALTITUDE Almost perfectly flat, with maximum drop (over 2,000ha) of 8m the rest being 30m above sea level.

AREA The biosphere reserve covers 33,307ha of which 11,054ha is declared a zapovednik.

LAND TENURE State owned

PHYSICAL FEATURES The plain in which the Reserve is situated slopes gently to the south and southwest, maximum difference of altitude being no more than a few metres. Of the numerous depressions known as 'pods' (2-8m in diameter and 10-20cm deep), the largest named Bol'shoy Chaplinskiy of 2,000ha, is periodically flooded in spring. Most of these pods are enclosed by hardly noticeable shallow channels whilst the larger ones have radial water collecting ditches 1-2m deep and 8-10m in width. Soils are a mixture of solonetz, southern chernozems and dark chestnut with scattered solonchak types. Rivers are absent and the water table is at 19-20m, although clay loess linings to the pods tend to retain accumulated water, sometimes into summer. The climate is dry with hot summers and short, cloudy and sometimes cold winters. The temperature range from -3.6°C in January to 23.4°C in July with annual mean of 9.4°C and an annual rainfall of only 380mm. Dry winds and dust storms occur in spring with wind speeds of 25 miles per second with frosts in October, snow cover is present from mid-December to March, with a thickness of 10cm.

VEGETATION The feather grass steppe, the protection of which was a principal objective of this reserve, is dominated by the feather grasses Stipa lessingiana, S. ucrainica and S. capillata, together with fescue Festuca sulcata and crested hair grass Koeleria cristata. Herbaceous plants include abundant Pyrethrum millefoliatiatum, Galatella villosa, and Artemisia austriaca. Other typical species are Tulipa schrenkii and T. biebersteiniana, purple mullein Verbascum phoeniceum, Iris pumila, the plumbago Goniolimon tataricum and summer cypress Kochia prostrata. The swampy 'pods' have fox-tail Alopecurus pratensis, couch-grass Agropyrum pseudacaesum, sedge Carex praecox and in flooded places flowering rush Butomus umbettalus and Scirpus supinus. Over 4,117 steppe plant species have been recorded, dominated by the grasses, with 40 species endemic to the southern Ukraine, 56 species classified are rare in the 'Red Book SSSR' and a further ten as threatened. The total number of all plant species and subspecies is estimated as 3,378.

FAUNA The mammals of the steppe include European suslik Citellus citellus, hamster Cricetus cricetus, social vole Microtus socialis and a distinct

subspecies of mouse Mus tataricus as well as polecat Putorius putorius. In total 18 mammals, six reptiles (Vipera ursini) and one amphibia have been recorded. Of the birds recorded, 16 are breeding and include the only site in the Ukraine for steppe eagle Aquila rapax as well as common species such as grey partridge Perdix perdix, stone curlew Burhinus oedicnemus, and short-toed lark Calandrella cinerea. During migration periods rarer species such as black stork Ciconia nigra, crane Grus grus, great bustard Otis tarda, demoiselle crane Anthropoides virgo, white-tailed eagle Haliaeetus albicilla and peregrine falcon Falco peregrinus are present and waterfowl such as whooper swan Cygnus cygnus and white-fronted goose Anser albifrons.

CULTURAL HERITAGE The reserve has some archaeological and historical interest.

ZONING/CONSERVATION MANAGEMENT Total biosphere reserve covers 33,307ha which zoned into a strict protection area (the zapovednik) of 11,054ha, contains the only remaining unploughed pristine feather-grass steppe in Europe covering 1,500ha. There is also an experimental stock-breeding area of 17,453ha and an outer buffer zone 1km wide covering another 4,800ha. The strict nature reserve status is modified over certain areas by the introduction and acclimatization of ungulates (such as Przewalski's horse, hartebeest, and gnu) and birds of the ostrich family under a paddock system and in conjunction with domestic stock. This area, the experimental stock-breeding zone, is managed by the Askania Nova Institute for steppe stock-breeding. At present, only 1,560ha is totally protected, the remainder being set aside for pasture, hay, an arboretum of nearly 400 species and a zoo in which introduced species such as zebra Equus grevyi, E. zebra Przewalski's horse E. przewalskii, eland Taurotragus oryx, hartebeest Alcelaphus buselaphus, gnu Connachaetes gnou and saiga Saiga tatarica are reared with considerable success. In addition to ostrich, the Ratite birds in the collection include the lesser rhea Pterocnemia pennata and emu Dromais novaehollandiae.

STAFF Fifty-eight of which 19 are researchers

LOCAL ADMINISTRATION 326332, Khersonskaya oblast', Chaplinskiy rayon, ngt. Askaniya-Nova, Ukrainkaya SSR.

VISITOR FACILITIES Tourism is restricted but recognized as one of the aims of the reserve.

SCIENTIFIC RESEARCH AND FACILITIES The objective is to undertake long-term studies on the dynamics of the grazed steppe ecosystem and monitoring any changes due to human activities. Study of vegetation dynamics, and population dynamics and ecology of wild species of grazers and browsers, with special reference to developing methods of protecting the rarer species in the wild and improved acclimatization to new localities, hybridization and breeding of animals in semi-natural environments. Special attention will be given to geosystem monitoring similar to that being carried out at the Central Chernozem State Reserve. There are fully equipped laboratories, a museum, botanic and zoological gardens, breeding paddocks and a scientific library.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve suffered damage during the war.

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Chatkal Mountains Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.36.12 (Pamir-Tian-Shan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Approved as a Biosphere Reserve in 1978

GEOGRAPHICAL LOCATION Located in the western Tien Shan in Uzbekistan SSR and Krigiz SSR, 70km to the east of Tashkent and 250km north-east of Tashkent.

AREA Total area of 71,400ha which includes the 47,500ha of Chatkal State Reserve and 23,900ha of the Sary-Chelek State Reserve.

Chatkal Mountains Biosphere Reserve: Chatkal'skiy Zapovednik Unit

BIOGEOGRAPHICAL PROVINCE 2.36.12 (Pamir-Tian-Shan Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1947 (Act of Council of Ministers of Uzbek SSR No. 2020) and approved as a Biosphere Reserve in 1978, twinned as a 'cluster reserve' with Sary-Chelek State Reserve.

GEOGRAPHICAL LOCATION Situated in Tashkent oblast' of the Uzbekistan SSR in the western Tyan-Shan Mountains at the south-western end of the Chatkal'skiy Range, 50km south-east of Tashkent. The reserve is 183km south-west of its twinned cluster reserve Sary-Chelek. 41°08'N, 69°59'E.

ALTITUDE 1,110-4,000m

AREA The reserve is 35,809ha but biosphere reserve area is 47,500ha

LAND TENURE State owned land

PHYSICAL FEATURES Spurs of the Chatkal'skiy mountains of medium altitude and alpine relief with the Bashkyzylsaya section occupying the southern slopes and the Maydantalu sector the northern slopes of the range. Rocky outcrops of Devonian and Carboniferous age are common with thin deluvial and eluvial deposits lying on shallow bed rocks and valleys are deeply entrenched. Soils are various brown earths. Climatic sharply continental mean temperature of the coldest months, January and February, is -2°C (at 1,200m) and mean temperature of the warmest month, July, is 20-25°C at low altitude with mean annual temperature of 11.5°C. Annual rainfall in low altitude areas is 600-900mm, average of 656mm at 1200m. The frost-free period is 200 days.

VEGETATION The reserve consists of 6,833ha of forest, 11,001ha of rocks and scree, 6,126ha of meadows, 1,938ha of sandy areas and 23ha of water areas, with three vegetation belts: mountain Turanian-type semi-savanna, forest/shrub vegetation, mostly juniper and hardwood with notable presence of wild forest tree species and alpine steppes. River valleys have tugai landscapes. Forest of the junipers Juniperus turkestanica, J. semiglobosa, and C. seraphsenanica and deciduous trees such as Prunus sogdiana, Acer turkestanicum, Crataegus turkestanica and Malus kirghisorum are present. South and west facing slopes

support mountain steppe and sclerophytic communities, including groves of Pistacia vera. Highland areas have herb and grass meadows.

FAUNA There are records of 32 species of mammals, 146 species of birds and four species of fish. Characteristic but rare species are white-claw bear Ursus arctos leucoryx, Menzbier's marmot Marmota menzbieri (E) (endemic to the West Tien Shan), snow leopard Panthera uncia (E) and the Siberian ibex Capra ibex sibirica as well as roe deer Capreolus capreolus. Birds include the snowcock Tetraogallus himalayensis at higher altitudes and numerous chukar partridge Alectoris chukar as well as golden eagle Aquila chrysaetos, booted eagle Hieraeetus pennatus, saker falcon Falco cherrug, lammergeier Gypaetus barbatus and black stork Ciconia nigra.

ZONING/CONSERVATION MANAGEMENT The reserve consists of a core zone of 35,200ha, split into two sections; the Bashkyzylsayu covering 11,100ha and the Maydantalu covering 24,200ha, and a buffer zone of 12,200ha. Within the core, 2,339ha are zoned for conservation and plant community restoration and another 34ha for the administrative centre. Managed as a strict nature reserve

STAFF Seventy-two, of which 25 are in administration, control and reserve management and 26 are researchers.

LOCAL ADMINISTRATION Uzbek SSR, Tashkent Region, Verkhnechirchiksky District, Parkent Village.

VISITOR FACILITIES Visits can be made only by special arrangement and must be guided along predetermined paths.

SCIENTIFIC RESEARCH AND FACILITIES Research is coordinated with the USSR Academy of Sciences since 1958 and includes the biology of wood producing plants and biology of rare animal species such as the marmot and snow leopard. Research is geared at the study of the complex structure and dynamics of the West Tien Shan mountains including the inventory of flora and fauna, and elaborating methodology for the reafforestation of mountains, especially the nut-tree forest areas. There are equipped laboratories, experimental plots, climatic stations and accommodation for scientists.

LOCAL POPULATION There is no participation in the reserve management and there are no settlements within the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Before reserve establishment part of the area was utilized for hunting and grazing, and for mineral prospecting.

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Chatkal Mountains Biosphere Reserve: Sary Chelekskiy Zapovednik Unit

BIOGEOGRAPHICAL PROVINCE 2.36.12 (Pamir-Tian-Shan Highlands)

LEGAL PROTECTION Total. The Reserve was set up by Order of the Council of Ministers of the Kirgiz SSR in 1959. In accordance with the Basic Principles

of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is prohibited both in the territory of the Reserve and within the protected zones set up around reserves.

DATE ESTABLISHED Established as a strict nature reserve in 1959, and accepted in April 1978 as a Biosphere Reserve, twinned as a 'cluster reserve' with Chatkal'skiy State Reserve.

GEOGRAPHICAL LOCATION Situated in the Osh oblast' of Kirgizskaya SSR in the western Tyan'-Shan mountains lying on the south and south-eastern slopes of the Chatkal'skiy Ridge between the western and eastern headwaters of the Kara-Suu river 91km north-east of Namangan and 157km north-west of Osh. 41°47'N, 71°54'E.

ALTITUDE 1,200-4,300m

AREA 23,868ha with the biosphere reserve being 23,900ha

LAND TENURE State owned under the administration of the Ministry of Agriculture of the USSR.

PHYSICAL FEATURES The reserve is on the southern spurs of the Chatkal range, the greater part of the territory being a high mountain basin protected to the north, west and east by the radial spurs of the mountain range. The high mountain parts contain rocky spike-like summits with firns and ridges with narrow and deep gorges, but where the mountains are lower the peaks assume a soft cupola-like character. The reserve includes the mountain lake Sary-Chelek (altitude 2,000m), 470ha and 245m deep, and a further six small shallow lakes. The central and lower region is strongly dissected, with a cover of nut-fruit forests which owe their origin to the favourable climate, itself in turn being influenced by local relief. In winter, when cold air fills the adjacent lowlands, a higher temperature prevails in the mountains, while in the summer the temperature is, on average, 10°C lower than in the Fergana valley. Mean annual temperature is 7.4°C (at 1,200m). The ranges retain the moist western air current, causing an annual precipitation of 837mm (at 1,200m), which is three to four times the annual rainfall on the neighbouring plains.

VEGETATION 8,229ha are forests, 8,022ha are meadows and steppe habitat, 4,902ha rocks and screes and 601ha of water bodies. The flora of the Reserve comprises 1,071 plant species, including 32 species of trees, 80 shrubs and 886 grasses, typical of the whole south-Kirghiz protected forest. Here there is a diverse alpine forest ecosystem with representatives of the north and south - relict walnut Juglans regia, fir Abies semenovii, spruce Picea schrenkiana and grape Vitis silvestris. There is a distinct altitude zoning in vegetation distribution: the alpine vegetation varies from tall-grass meadows, tree-shrub communities of juniper Juniperus sp., spruce Picea schrenkiana, fir Abies semenovii and broadleaved species. In the nut-fruit forests, the dominant species is the walnut, covering 50% of reserve with groups of apple Malus spp., pears Pyrus spp. and an understory of Prunus divaricata, abelia Abelia corumbosa, exochords Exochorda spp. and juniper Juniperus spp.. In the upper part of the belt, the nut forests give way to spruce and spruce-fir. The apple forests occupy smaller areas than the nut forests and in the former there is an abundance of prangos Prangos pabularia.

From 2100-2200m up to 2500-3000m stretches the subalpine belt, with juniper woodlands and spruce-fir in its lower regions thinning out gradually to subalpine meadows with a dense grass stand at higher altitude.

FAUNA The reserve supports 42 species of mammal (including five which are naturalized), 157 species of birds (including 118 nesting species such as golden eagle Aquila chrysaetos, lammergeier Gypaetus barbatus and snowcock Tetraogallus himalayensis), five species of reptiles, two species of amphibians and five species of fish. The fauna is most richly represented in the forest belt, the most characteristic species being the wild boar Sus scrofa, with large numbers of roe deer Capreolus capreolus. In autumn in the nut-fruit forests one may encounter the white-claw bear Ursus arctos leuconyx. The fauna of the alpine and subalpine belts is distinctive, including mountain goat Capra sibirica, argali Ovis ammon, snow-leopard Panthera uncia and lynx Lynx lynx. Ermine Mustela erminea and stone marten Martes foina are ubiquitous.

ZONING/CONSERVATION MANAGEMENT The reserve is at present zoned

STAFF 105 with 20 administrative, control and resources management staff and five researchers.

LOCAL ADMINISTRATION Sary-Chelek Reserve, p/o Arkit, Dzhangi-dzhol' District, Osh Region, Kirgiz SSR, 716705 USSR.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The flora and fauna are currently being itemized and the biology and ecology of individual species of mammals (predatory, hoofed) and birds are being studied. Special attention is being paid to a study of the structure of the plant cover, the biological features of the main species of fruit trees and shrubs and other commercially valuable species and methods of conservation and reafforestation of mountains, especially nut-forests. In the international research programme, this district may serve as a natural control for obtaining comparative indices on pollution. Monitoring of background biotic and abiotic parameters is done on a periodic basis and includes measurements of dust content, sulphur dioxide, mercury, lead, cadmium, arsenic carbohydrates and litter decomposition rates and zone levels. The territory is accessible for research and contains experimental plots, a climatic station and accommodation for scientists. There is some environment education work.

MODIFICATION OF THE NATURAL ENVIRONMENT Before the creation of the reserve, selective logging of the forest, hay mowing and grazing of cattle were practised. There is no participation in management decisions taken in the reserve. Since 1960, all farming activity has ceased in the core area; only fire protection and management measures are carried out.

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Kavkazskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.34.12 (Caucaso-Iranian Highlands)

LEGAL PROTECTION Total. The Reserve was set up by Decree of the Council of People's Commissars of the RSFSR in 1924. In accordance with the Basic Principles of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is forbidden both in the territory of a reserve and in the protected zones set up around reserves.

DATE ESTABLISHED Reserve established in 1924 and approved as a Biosphere Reserve in 1978.

GEOGRAPHICAL LOCATION In the western part of the Caucasian range, split between Adygeyskaya Autonomous Oblast', in Krasnodarskiy Kray and the Karachaevo-Cherkesrkaya Autonomous Oblast' of the Stabropol'skiy Kray of the RSFSR, the majority lying in the former. The reserve has 21km forest of Sochi. Separate from the main territory of the reserve is the Khost yew-box forest (Khost region, near Sochi) and the Sochi zoo-forest park. 43°46'N, 40°21E.

ALTITUDE 0-3,360m

AREA The reserve covers an area of 263,477ha

LAND TENURE State property, under the administration of the Ministry of Agriculture of the USSR.

PHYSICAL FEATURES The territory of the reserve represents a typical mountainous landscape, with steep mountain forests, river valleys and alpine tundra along two very large elevations: the main Caucasian range and the forward range situated to the north of the main range. Glaciers and firns feed numerous watercourses; two large rivers, the Bol'shaya Laba and the Belaya, and their tributaries (Malaya Laba and Kisha) dissect the northern slope of the main range into spurs. The rivers of the southern slope - Mzymta, Sochi, Golovinska (Shakhe) - flow into the Black Sea. Between the main and the forward range lies the southern depression, parallel to which run the valleys of the rivers Zakan, Umpyrki, Achipsty, Alous and Aspidnoi. The climate varies, with the Caucasian Range acting as a barrier separating the wet and hot Black Sea region from the drier and colder districts of Transkuban and Near Caspian. The heaviest rainfall occurs on the southern slopes of the main range, with an annual precipitation sometimes exceeding 3000mm at 1800-2500m. To the east, the rainfall decreases, and in the basins of the Malaya Laba and Bol'shaya Laba is only 700-900mm a year.

VEGETATION The reserve consists of 162,319ha of forest cover and 1,994ha of water areas. The vegetation of the reserve reflects the complex history of the existing surface of the West Caucasus initially selected to represent the Black Sea-Ghirkan province of broad leaved mountainous forests, the heavy ruggedness of its relief and the variety of climate. Over 1,500 species of higher plants are present, increasing to 3,000 if we include the diversity of mosses, fungi, lichens and algae, 20% of which are endemic. Of interest are the large number of tree-shrub species, 165 in all. In the reserve, Tertiary relict plants have been preserved - representatives of the ancient pre-glacial flora of the Caucasus: Caucasian fir Abies nordmanniana, oriental beech Fagus orientalis, chestnut Castanea sativa, oriental spruce Picea orientalis,

Iberian oak Quercus iberica, sycamore maple Acer pseudoplatanus, Caucasian lime Tilia caucasia etc. A large part of the reserve is covered by forests. In the mountain belt, broadleaved forests grow to 1,200-1,300m, with oak forests on the light southern slopes at 800-900m. Beech forests are widespread, often covering the whole southern slope of the main range from 500m to the upper forest boundary, but firs predominate, accounting for about two-thirds of all the forest area. From 2,300-2,500m, vegetation of the subalpine meadows gives way to vegetation of the alpine belt extending up to 2,800-2,900m.

FAUNA The number of mammalian species recorded is 59. There are 192 species of birds, over 132 of which breed including lammergeier Gypaetus barbatus, griffon vulture Gyps fulvus, black vulture Aegypius monachus and golden eagle Aquila chrysactos. The West Caucasian fauna is most widely represented with large numbers of wild goat Capra caucasica, champi Rupicapra rupicapra and wild boar Sus scrofa; roe deer Capreolus capreolus are seen in the strip of broadleaved forests. In 1940 bison Bison bonasus were reintroduced into the Caucasus, and now number 900 in the Caucasus Reserve and the adjoining territories.

ZONING/CONSERVATION MANAGEMENT The reserve is in two sections. The main mountainous sector and the Khostin yew-box forest covering 301ha and a buffer zone is being set up around the reserve. The Decree setting up the Caucasian State Reserve specifies the entire area as a single territory.

STAFF 180 permanent staff

LOCAL ADMINISTRATION Caucasian Reserve, Sukhumskoe Shosse, 7a, Sochi X-67 Krasnodar Territory, RSFSR, 354067, USSR.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Since the reserve was established, an inventory has been taken of the flora and fauna, and the biology and ecology of individual (particularly rare) species are being studied. In 1976, a comprehensive programme was initiated to study the structure and dynamics of the main ecosystems of the north-west Caucasus. The effects of fire and logging on the ecosystem are also being monitored. The territory is accessible for research, both of an expeditionary and stationary character.

LOCAL POPULATION No settlements within the reserve

MODIFICATION OF THE NATURAL ENVIRONMENT The natural complex of the Caucasus Reserve has been very little modified by human activity; most of it has never been subjected to tree-felling and a large part of the alpine meadows has never been grazed by domestic cattle.

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Oka River Valley Biosphere Reserve: Okskiy State Reserve Unit

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Boreonemoral)

LEGAL PROTECTION Total

DATE ESTABLISHED Set up by Act of the Council of People's Economy in 1935 followed by under No. 21 January 25 in 1940.

GEOGRAPHICAL LOCATION In the south-east part of the Meshcherskaya lowlands in Ryazan'Oblast westwards along the north bank of the river Pra and lying 225km south-east of Moscow and 70km east of Ryazan. 54°43'N, 40°50'E.

ALTITUDE 80-100m

AREA Total area of 40,900ha (Total area of Oka River Valley Biosphere Reserve is 45,845ha and consists of two separate zapovedniki, Okskiy Zapovednik and Prioksko-Terrasnyy Zapovednik.)

LAND TENURE State owned

PHYSICAL FEATURES Outwash plains with a system of flat sand ridges between the Oka and Pra rivers, the whole area being one of fluvo-glacial sediments with modern alluvial sediments in the Oka valley. Lowlands are occupied by swamp areas with soils which are largely podsolic, peaty, boggy or with other floodplain characteristics. Temperatures range from 19.8°C in July to -9°C in January with 120-150 days below 0°C with annual mean of 4.2°C. Total rainfall is estimated at 500-534mm with fluctuations up to 918.5mm.

VEGETATION The mixed forest composed largely of Scots pine Pinus sylvestris (on sand dunes) with a mixture of birch Betula and other broadleaf species such as oak Quercus robur and alder Alnus glutinosa (on floodplain). The drier areas lying to the east have oak and alder, with a dense undergrowth of lime Tilia cordata and nettles Urtica dioica. An area of 1,723ha is sphagnum and moss bog with a further 1,036ha of willow bog, with areas of lakes and birch Betula pendula and B. pubescens with alder woods. Relict plant species include the water caltrop Trapa natans and Salvinia natans. In total 810 species of flora have been recorded including 69 classified as rare and five as endangered.

FAUNA There are 58 species of mammals, 229 species of birds 34 species of fish and 10 species of amphibian. Mammals include the Russian desman Desmana moschata (V), red squirrel Sciurus vulgaris, introduced beaver Castor fiber, wolf Canis lupus (V), badger Meles meles, otter Lutra lutra, pine marten Martes martes, wild boar Sus scrofa and elk Alces alces together with introduced sika deer Cervus nippon. Lynx Lynx lynx and brown bear Ursus arctos are recorded but rarely. Birds include many waterfowl in passage together with breeding species such as the black stork Ciconia nigra, white-tailed eagle Haliaetus albicilla, osprey Pandion haliaetus, short-toed Eagle Circaetus gallicus, capercaillie Tetrao urogallus, crane Grus grus and others.

ZONING/CONSERVATION MANAGEMENT The reserve covers 22,896ha which is the core zone which is under strict protection and only research activities are permitted. A 300ha area has been set aside for a breeding station for European Bison together with smaller areas for breeding rare species of cranes and birds of prey. To the south and east of the reserve there is an additional peripheral buffer zone of 20,000ha where development is allowed but

hunting, fishing and recreation is restricted. Strict Nature Reserve. Some restructuring is taking place.

STAFF Total staff of 132 with 24 engaged in administration, control and resource management, and three PhD level and 18 university trained research workers.

LOCAL ADMINISTRATION Ryazan Region, Spassky district, P.O. Lakash 391072 RSFSR.

VISITOR FACILITIES None, but there is a bus service with Ryazan.

SCIENTIFIC RESEARCH AND FACILITIES Research is conducted into the forest ecosystem; the ecology of species such as the desman Desmana moschata, beaver Castor fiber, elk Alces alces, black stork Ciconia nigra; complete inventory of birds, including those of the adjoining Menshaheva lowlands, and population dynamics of rare mammals. Research is coordinated by the Academy of Sciences and there is a research station, a field station together with experimental plots, climatic station and accommodation for scientists. Monitoring activities cover climate, vegetation, hydrology, plant and animal populations and harvesting of these populations. There are ecological displays and lecturing facilities.

LOCAL POPULATION None present on the reserve. The local population does not participate in management decisions.

MODIFICATION OF THE NATURAL ENVIRONMENT The whole region was logged over prior to the establishment of the reserves and restricted areas are still used as meadows. Introduced species include beaver and European bison as well as Cervus nippon.

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Transactions of the Okskiy Zapovednik issues 1-14.

Oka River Valley Biosphere Reserve: Prioksko-Terrasnyy State Reserve Unit

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Boreonemoral)

LEGAL PROTECTION Total. In accordance with the Basic Principles of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is forbidden both in the territory of a reserve and in the protected zones set up around reserves.

DATE ESTABLISHED The reserve was set up by Order of the Council of People's Economy of the RSFSR in 1945 and created in 1948. Accepted as a Biosphere Reserve and twinned with Okskiy zapovednik. (Oka River Valley Biosphere Reserve was established in 1978 consisting of two separate zapovedniki Okskiy Zapovednik and Prioksko-Terrasnyy Zapovednik).

GEOGRAPHICAL LOCATION On the north side of the valley of the river Oka, 10km east of Serpukhov, and 100km south of Moscow, in the Moskovski Oblast. 54°53'N, 37°49'W.

ALTITUDE 180-200m

AREA 4,945ha (Total area of Oka River Valley Biosphere Reserve is 45,845ha)

LAND TENURE State property, under the administration of the Ministry of Agriculture of the USSR.

PHYSICAL FEATURES The Prioksko-Terrasnyy Zapovednik is in the central east European plain in the transition zone between the broadleaved and mixed forests and climatically, it is in the temperate belt. The reserve is situated on the afforested fluvial terraced slopes of the river Oka and contains two small rivulets one draining into the river Oka and the other into the Oka floodplain marshes. The temperature ranges from -10.4°C in January to 18.2°C in July with a mean annual precipitation of 513mm.

VEGETATION The reserve has 4,537ha of forest (10ha of water) which is 90% of the total area, with the main species being pine mixed with birch, oak and lime. The sandy terrains above the flood terraces has pine and spruce forest with elements of taiga and sphagnum bogs (Andromeda polifolia, Oxycocous quadripetalus and Drosera rotundifolia). On the drier areas there are relict meadow-steppes (covering 36ha) with steppe and upland species present (Aconitum anthora, Carex obtusa, Dentaria tenuifolia, Stipa jeannis, Festuca sulcata, Phleum phleoides, Tulipa biebersteiniana, Cerasus fruticosa, Veratrum nigrum) which includes some 50 species, many of which are 150-600km away from their main area of distribution. In total 892 species of flora have been recorded including 29 classified as rare and 18 as endangered.

FAUNA In the reserve, 48 species of mammals, and over 130 species of birds have been recorded, many native to broadleaved forests (Clethrionomys glareolus, Apodemus flavicollis, Picus viridis, etc.) others to the taiga zone (Tetrao urogallus, Tetrastes bonasia, Lepus timidus) and open spaces (Microtus arvalis), as well as such widespread species as Vulpes vulpes, Sorex araneus and Alces alces. In the reserve and adjacent lands, the European beaver Castor fiber, roe deer Capreolus capreolus and wild boar Sus scrofa have been reintroduced, and there is a breeding station for bison Bison bonasus. There are eight species of fish recorded.

ZONING/CONSERVATION MANAGEMENT Core zone corresponds to the reserve area. The bison breeding site is peripheral but included in the core. In the north-west part of the reserve, an area of 200ha has been set aside as a breeding station for bison.

STAFF Permanent staff of 71 with 14 engaged in administrative, control and reserve management work and three PhD level and five university trained researchers.

LOCAL ADMINISTRATION Prioksko-Terrasnyy Zapovednik, P.O. Danki, Serpukhov District, Moscow Oblast, RSFSR, 142274.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Most of the research work on the reserve consists of a comprehensive study of the structure and function of natural ecosystems and their dynamics, and an investigation of methods for conserving

and breeding rare animal and plant species. Since 1976 the reserve, together with the Experimental Station of the Institute of Agrochemistry and Soil Science, USSR Academy of Sciences and the Pushchino Scientific Centre for Biological Research, have been engaged in biosphere monitoring including climatic, vegetational and plant population measurements.

LOCAL POPULATION Apparently do not participate in the management decisions of the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT All economic activities are prohibited throughout the reserve. During the Second World War, part of the reserve (about 900ha) was subjected to felling, but the forests in this area have now been restored. There are no constructions; the service buildings and a residential estate (central settlement, cordons) are located at its boundaries. Excursion routes are laid down along the western boundary, but the impact of tourism on the protected territory is negligible, although there is a bus service from Serpukhov.

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Repetek Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.21.08 (Turanian)

LEGAL PROTECTION Total. In accordance with the Basic Principles of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is forbidden both in the territory of a reserve and in the protected zones set up around reserves.

DATE ESTABLISHED The Repetek Reserve has been in existence since 1928 and the Repetek Sand-Desert station since 1912. The current boundaries of the reserve were laid down by Order of the Council of Ministers of the Turkmenian SSR in 1952. Approved as a Biosphere Reserve in April 1978.

GEOGRAPHICAL LOCATION Situated in the Chardzhou oblast' of the Turkmenskay SSR on the eastern edge of the Kara Kum desert in the Shirshutyur Sands, 54km south-west of Chardzhou and the valley of the river Amubar'ya. 38°16'N, 63°13'E.

ALTITUDE 180-220m

AREA 34,600ha

LAND TENURE State property, under the administration of the Academy of Sciences of the Turkmenian SSR.

PHYSICAL FEATURES The Repetek Reserve is an alluvial plain in the central part of the eastern Kara Kums and represents the Turan desert province. It is made up of sandy drifts of the pra-Amudar topped with overblown aeolian sands

(30m thick and 4m high). All the main types of ecosystem characteristic of the eastern Kara Kums are present in the Reserve, and its landscape is characterized by an alternation of large sandy ridges (up to 10m high), valley-shaped depressions and massifs of barkhan (ten to hundreds of metres in length) and sodded sand dunes. The mobile barkhan sands with practically no soil cover are usually covered with a highly rarified vegetation. On the sodded sands and typical sandy desert soils of the interridge depressions, Haloxylon persicum predominates in the shrub layer and Carex physodes in the grassy cover, while the well-formed soils in the valley-shaped depressions are usually covered with Haloxylon ammodendron woodlands forming small patches of 'desert forest', which in valley depressions with light mineralized ground water may reach 4-5m in height. The reserve has a climate typical of continental subtropical deserts with rich thermal resources (140-160kcal/sq.cm), and its mean annual precipitation, mostly in the form of rain, is 1145mm (85% falls in the winter-spring period). Temperature ranges from 0°C in January and 32°C in July, with high daily and seasonal temperature variations.

VEGETATION The flora of the reserve is represented by 211 plant species, belonging to 24 families with 135 native species and 37% endemics. The most characteristic are the species of Chenopodiaceae (Haloxylon persicum, H. ammodendron), Polygonaceae (Calligonum spp.), Leguminosae, Cyperaceae, and Gramineae. Mosses are represented by one species, Tortula desertorum. Eight species of higher fungi are present, and the family Agaricaceae predominates. Characteristic of the flora of the reserve is the high specialization in xerophilia and psammophilia, including some highly specialized desert types adapted to grow on mobile sands of barkhan ridges, and also on the saline clay depressions called 'takyrs' and the large number of endemic species 78 species. Of these endemic species, the most characteristic are Calligonum arborescens, Eremosparton flaccidum, Smirnowia turcestana, Aristida karelinii, Corispermum papillosum, Girgenschnia minima, Acanthophyllum korolkovii. Rare species include Iris longiscapa, Eremurus anisopterus, Tulipa sogdiana, Schummania karelinii and Cistanche ambiguus. The plant cover is represented by the communities of four formations of desert vegetation: Calligonum arborescens, C. caput-medusae, Haloxylon persicum and H. ammodendron. The formations of Calligonum spp. are disseminated on the moving and weakly-fixed sands and occupy 34% of the area, The white-Saxaul Haloxylon persicum formation includes diverse associations, among which the most characteristic are Haloxylon persicum-Aristida permata developed on the weakly-sodded sands of the ridges and Haloxylon persicum-Carex physodes and Haloxylon persicum-Carex physodes-Tortula desertorum on the fixed hummocky sands. The communities of this formation occupy 44% of the area. The plant communities of the black-saxaul formation (Haloxylon ammodendron) occupy an insignificant area (5%) and are associated with the valley-shaped depressions. They are distinguished by their very high productivity compared with the other communities of the sandy desert.

FAUNA The fauna of this reserve is predominantly psammophilous, with a high percentage of endemic forms. Twenty-nine species of mammal have been recorded, of which the piebald shrew Diplomesodon pulchellus, the comb-toed jerboa Paradipus ctenodactylus, desert jerboa Jaculus lichtensteini and the long-tailed ground-squirrel Tamias spp. are all confined to the sandy deserts of Turan, while the goitred gazelle Gazelle subgutturosa, caracal Felis caracal and marbled polecat Vormela perguana are among the seven species present in the reserve which are decreasing sufficiently to be listed in the Red Book of Rare and Vanishing Animals of the USSR. Although only 25 species of birds nest here, 12 being resident and the rest partially migrant, this number increases to about 196 during the spring and autumn migrations.

Noteworthy are the endemic saxaul jay, the short-toed eagle Circaetus gallicus, golden eagle Aquila chrysaetos and desert sparrow Passer simplex, all of which are listed in the 'Red Book'. The most spectacular of the 23 species of reptile of the reserve is the largest lizard of the USSR - the desert monitor Varanus grisens which, though it is frequently encountered, is yet another 'Red Book' species; the sole poisonous snake, the saw-sealed viper Echis carinatus, is also common. The endemics of the Turan deserts include the sand-snake Eryx miliaris, geckos Crossobamon eversmanni and Teratoseinus scincus, lizards Phrynocephalus mystaceus, Eremias grammiea, E. lineolata and the little sand constrictor Eryx miliaris. Of the 1,000 or so invertebrates found in the reserve - amongst which is Anthia mannerheimi, one of the largest ground-beetles of the USSR - about 70% are endemic, many being found mainly in the sandy deserts of the southern subzone.

ZONING/CONSERVATION MANAGEMENT The Territory of the reserve and the areas adjoining form two zones: there is a natural core zone of 15,000ha, which is a completely undisturbed part of the desert. It includes the main forms of the relief of the moving and fixed sands, the main plant formations of the Kara Kums and containing the most characteristic representatives of the animal kingdom. There is also an experimental buffer zone of 19,600ha, where different experiments are permitted, the most important being scrub clearance, sheep and camel grazing, fixation of the moving sands and a study of their influences on the ecosystems.

STAFF Twenty-five permanent staff at the Repetek Sand-Desert Station and Reserve of the Academy of Sciences of the Turkmenian SSR.

LOCAL ADMINISTRATION Repetek Reserve, p/o Repetek, Chardzhou Region, Turkmen SSR, 746060 USSR.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research is conducted jointly with the Sand-Desert Research Station of the Institute of Desert Research of the Turkmenian Academy of Sciences. The scientific activity of the Repetek sand-desert station and the Reserve has included: 1) investigation of the seasonal and multi-annual dynamics of the individual components of the sand-desert ecosystems - lithogenic basis; moisture regime of the areas of soil grounds; phenology; productivity and successive changes in the plant cover; the composition and distribution of animals; and 2) feasibility study of using the desert territories for plant breeding, forestry management and rational use of plant resources. Attention is now centred on a comprehensive investigation of the most typical ecosystems of the sandy desert - barkhan sands with rarified vegetation, white saxauls on sand hummocks, black saxauls along the valley-like depressions. A large part of the combined studies has been carried out, mostly in the reserve. The reserve occupies an important place in the international research programme, and in the years 1965 to 1974 research was carried out under the International Biological Programme (IBP) and since 1975 under MAB. The reserve and the sand-desert station are linked to the large towns of Central Asia by rail and road, and are fully accessible to investigators. There is also a herbarium and a museum. The regional centre, the town of Chardzhou, is 54km from the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT In the natural zone, the human impact is negligible. In the experimental zones, almost everywhere one observes moderate or, in places, heavy grazing by sheep and camels. In the buffer zone, a study is recommended of the natural restoration processes of the natural complexes and different stages of their induced modification by man.

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Sikhote-Alin Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.14.05 (Manchu-Japanese Mixed Forest)

LEGAL PROTECTION The reserve was set up by Order of the Council of People's Commissars of the RSFSR in 1935. In accordance with the Basic Principles of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is prohibited both in the territory of the reserve and within the protected zones set up around reserves.

DATE ESTABLISHED The reserve was created in 1935 and approved as a Biosphere Reserve 1978.

GEOGRAPHICAL LOCATION The reserve is situated in the coastal mountain range of the Sikhote-Alin' in the central eastern part of the Primorskiy Krai administrative region, due west and south of the town of Ternei and some 400km north east of Vladivostok. The reserve includes about 25km of coastline (in two sections) on the Sea of Japan. 44°46'-45°45'N, 135°48°-136°35'E.

ALTITUDE 0-1,600m

AREA The reserve covers 347,532ha with the Biosphere Reserve being 340,200ha

LAND TENURE State owned

PHYSICAL FEATURES The reserve is situated in the central eastern part of Sikhote-Alin which is here represented by a complex system of mountain ranges, where plains account for less than 5% of the territory. The reserve is influenced by the East-Asian monsoons; its climate is characterized by a dry, cold winter (-20°C and 90-140 days without frosts) and a moderately hot summer. The mean annual rainfall is 778mm, and precipitation varies seasonally (upto 1100mm), the greater part occurring in the summer. Winds are a characteristic feature of the climate: in summer, weak southerly and south-easterly winds bring either fogs or overcast weather; in winter northerly and north-westerly winds are dry, cold and very violent; along the coast storms and typhoons are frequent.

VEGETATION The reserve is located within the geobotanical regions of the East Asian conifer-broadleaved and the South Okhotsk dark conifer forest with the vegetation of the reserve is representative of the Manchurian, Okhotsk, East Siberian and Mongolian floras rich in relict and endemic forms, and with a varied species composition. The major eastern and western slopes of Sikhote-Alin differ in vegetation composition, the dominant formation of the littoral part of the reserve being broadleaved with cedar forests of Pinus koraiensis, with the inland part having dark conifer fir-spruce forests with an underwood of Rhododendron fauriei, relict groupings of Echinopanax elatum and scattered and broadleaved and conifer forests with Primula jesoensis storey. The great floristic diversity of the area is shown by the presence of nearly all the plant formations of the Ussuriysk Region with records of 940 species of higher plants, in the broadleaved and cedar forests, as well as over 46 species of trees, 68 species of shrubs and lianes and over 80 species of grasses: species include Ulmus propinqua, Fraxinus manshurica, Phellodendron amurense, Taxus cuspidata, Populus maximoviczii, Vitis amurensis, Schizandra chinensis, Adiantum pedatum, and Osmunda cinnamomea.

FAUNA The fauna of the reserve is rich and varied, with 61 species of mammals, over 340 species of birds, 12 species of amphibians and reptiles, and 16 species of freshwater fish. It includes southern species of goral Nemorhaedus goral, tiger Panthera tigris, (five-seven animals) Asiatic black bear Selenarctos thibetanus, musk deer Moschus moschiferus, wolf Canis lupus, wolverine Gulo gulo and brown bear Ursus arctos as well as many other palaearctic species.

ZONING/CONSERVATION MANAGEMENT The reserve includes three game sanctuaries; the meteorite craters of Sikhote-Alin, Lake Blagodatnoe and a special faunal reserve for the protection of the goral. There are two coastal sections covering some 25km in all. There is a buffer zone of up to 1km wide surrounding the reserve. The reserve is administered by the Ministry of Agriculture and comprises little-transformed biogeocenoses which are being successfully restored without the intervention of man. Outside the reserve, large areas of forest are subject to constant intensive economic activity.

STAFF Ninety-eight permanent staff

LOCAL ADMINISTRATION Sikhote-Alin Zapovednik, 692150 pos. Terney, Terneyskiy r-n, Primorskiy Kray.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Since the reserve was established, work has been carried out on inventories of the flora and fauna, studying the biology and ecology of individual species (primarily rare and valuable) of plants and animals, and collecting information on the natural processes occurring in the ecosystems of the reserve. In the last six years increased emphasis has been given to comprehensive biogeocenological study of the problems of protection, reproduction and rational use of the natural resources of the region. Specific research projects have included the analysis of the chemical composition of precipitates (rain/snow); the distribution and transformation of vegetation cover, and the productivity of individual species and ecosystems. The research centre is situated in the Ternei settlement on the coast.

MODIFICATION OF THE NATURAL ENVIRONMENT Before its designation, about half the reserve was exposed to minor modification (felling of forest, fires), but all economic activity is now forbidden. However, two highways (total length 60km) have been constructed within the reserve.

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Tsentral'nochernozem Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Pontian Steppe)

LEGAL PROTECTION The Reserve was set up by Order of the Council of Ministers of the RSFSR in 1935 and in accordance with the Basic Principles of Land Legislation of the USSR and the Union Republics, any activity disturbing the natural complexes of reserves or threatening the conservation of natural objects of special scientific or cultural value is prohibited both in the territory of the Reserve and within the protected zones set up around reserves.

DATE ESTABLISHED Established in 1935 with the present boundaries set up in 1969 and approved as a Biosphere Reserve April 1978.

GEOGRAPHICAL LOCATION The Tsentral'nochernozem Zapovednik lies within the central Russian uplands and the East-European steppes and consists of sectors located in the Kursk and Belgorod Oblast's, some 550km south of Moscow and 125km north of Khar'kov. The Streletskii and Kazatskii lie in the south-western part at the watershed divide of the rivers Seym and Psla (Dnepr river basin) and the Yamskii, Barkalovkol and Bukreevy Barmami lie in the south-east, the Yamskii at the watershed divide of the rivers Oskola and the North Donets, the Barkalovkol and Bukreevy Barmami at the divide of the rivers Oskol and Ksheni (Don river system). Administratively, the reserve is split into two regions with the administrative centre for the Streletskii, Kazatskii, Barkalovkoi and Bukreevy Barmami sectors at Kursk and for the Yamskii sector at Belgorod. Centred on 51°00'N, 36°40'E.

ALTITUDE 230-263m

AREA 4,795ha in total consisting of Streletskii 2,046ha; Kazatskii 1,637ha; Bukreevy Barmami 232ha; Barkalovkoi 365ha; and Yamskii 515ha.

LAND TENURE State property, under the administration of the Board for Hunting and Reserves attached to the Council of Ministers of the RSFSR.

PHYSICAL FEATURES The reserve sectors represent meadow-steppe virgin land of the central Russian uplands, with preserved thick chernozems (upto 90cm), and a rich and diverse vegetation with a lack of permanent surface water

climatically, the reserve is situated in a zone of moderate wetness, with a total annual rainfall of 570mm, of which 70% occurs in April to October. Mean annual temperature is 5.3°C (-9°C in January and 18.7°C in July) wih 230 days frost free.

VEGETATION The vegetation is characteristic of the forest-steppe of the European part of the USSR and consists of a number of plots of virgin grassland (of stipa and brome) (200ha-5,000ha) amongst ploughlands and 1,560ha of forest. There are broadleaved-herbaceous meadow-steppes, oak forests and communities with ice age relict plants of the: Androsace kosopolyanskii, Bupleurum multinerve, Daphne iuliae, Dendranthema zawadskii, Schivereckia podolica, etc. 876 species of higher vascular plants are present, including 12 species listed in the Red Book of Rare and Vanishing Plants of the USSR (1975): the most notable being Adonis vernalis, Cotoneaster alaunicus, Crambe tatarica, Fritillaria ruthenica, F. meleagris, Lilium martagon and Stipa pennata. A characteristic feature of the steppe communities is their complex structure. The oak groves have a open character, with extensive glades consisting of steppes.

FAUNA The fauna is typical of the central forest-steppe and steppe habitat, with 40 species of mammals, 150 species of birds (including honey buzzard Pernis apivorus, buzzard Buteo buteo, black kite Milvus migrans), and several thousand species of insects. Large numbers of predators and hoofed animals (elk Alces alces, roe deer Capreolus capreolus and wild boar Sus scrofa) are present. The entomofauna of the reserve includes, along with widespread species of the European-Siberian group, boreal, steppe and Mediterranean species.

ZONING/CONSERVATION MANAGEMENT Some of the grassland sections, and all of the wooded areas are under 'strict regime' management. A buffer zone 1km wide has been set up around the resrves (amounting to 1566ha) to lessen the impact of the surrounding economic activities. Large portions of the agricultural lands are further designated as 'experimental agricultural areas' where activities are guided to research. A traditional four-year rotation grazing and crop production (hay) volume is operated whereby each plot is mown for three years and left unmown for one year. Controlled burns are also occasionally performed. For comparative study a number of management systems are employed including areas mown, grazed and permanently unmown (absolutely preserved). There are strict regime cores within the reserves which are left in their natural state and a buffer zone where hunting, pesticides, and introduction of exotic plants and animals is prohibited.

STAFF Seventy permanent staff

LOCAL ADMINISTRATION Central-Chernozem Reserve, 307028 Kurskaya Obl. g. kursk. p/o Zapovednoe.

VISITOR FACILITIES There is no tourism or general visitor access although some educational and scientific visits are permitted.

SCIENTIFIC RESEARCH AND FACILITIES The reserve headquarters and main operational buildings are located in the Streletskii sector. The forest-steppe natural complex of the reserve is being studied to determine the water and temperature regime of the soil, the dynamics of vegetation by season and in different years, the animal population including long-term studies of the breeding bird species, the formation of the fertile thick chernozem soils, the relationship between woodland and grassland communities under moderate and deficient water regimes and the ecology of a number of plant and animal

species. Together with the Kursk Experimental Station of the Institute of Geography, USSR Academy of Sciences, detailed investigations are being made into the structural and functional organization of the dominant biogeocenoses of the forest-steppe. The central Chernozem reserve, lying in an area of intensive farming and developed industry, including local air quality as a control area for monitoring changes in the natural environment.

MODIFICATION OF THE NATURAL ENVIRONMENT The major shortcoming is the relatively small size of the sectors, too small to maintain avian and mammalian populations and possibly too small for botanical conservation. A potential problem is represented by the neighbouring iron ore mines, which being open cast may cause aerial and ground water pollution threats. Lead levels are now six times as high as before World War II.

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Astrakhanskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.21.08 (Turanian)

LEGAL PROTECTION Total protection approved by Ministry of Agriculture 10 December 1967.

DATE ESTABLISHED Established in April 1919 boundaries designated in 1923 and approved as a Biosphere Reserve in 1984. The area was declared a Ramsar Wetland in 1976.

GEOGRAPHICAL LOCATION The reserve is split into three sections separated over a distance of 140km in the delta of the Volga River on the north-western shores of the Caspian Sea, between 50 and 70km south and east, respectively, of Astrakhan. 45°34'N, 47°44'E to 46°17'N, 48°57'E.

ALTITUDE 0-28m

AREA 63,400ha consisting of three sections of 26,062ha, 9,292ha and 28,046ha from west to east.

LAND TENURE State owned

PHYSICAL FEATURES It has a well developed hydrographic network consisting of a system of islands divided by channels of the Volga which discharge into shallow bays. Depending on the water level, upto 90% of the reserve is water

(57,569ha). The reserve is in three sections: (1) Damchiksky in the western delta; (2) Trekhizbinsky in the central delta; (3) Obzhorovsky in the eastern delta. The climate is sharply continental. The soils are alluvial meadow, often saline. Mean January temperature is -6°C, mean July temperature is 24°C and 100 days annually are below 0°C. Precipitation totals 200mm annually and prolonged flooding is characteristic of the region, the reserve being flooded for two months annually.

VEGETATION This is zonal dependent on age and relief of the alluvial islands and on the hydrological regime and formed in succession from channel to shore: water up to one metre deep with Vallisneria spiralis in dense patches; vast reed beds with Phragmites communis and Typha angustifolia; salt meadows consisting of solonchak soils with tamarisk and willow forest of Salix triandra and S. alba on the islands, occasionally mixed with Populus sp. and Ulmus sp. The shallow bay areas known as kultuks have submerged and floating vegetation which includes the Caspian lotus Nelumbo nucifera. Other water plants include Salvinia natans, Najas marina and N. minor, Nymphaea alba and N. candida and perfoliate and fennel-leaved pondweeds Potomogeton perfoliatus and P. pectinatus. The liquorice plant Glycyrrhiza glabra is also to be found. During floods, partially submerged water reservoirs overgrown with reeds and meadow grasses are created which are spawning grounds for important commercial fisheries. In total there are 278 plant species recorded.

FAUNA The 31 species of mammals include wolf Canis lupus, otter Lutra lutra, ermine Mustela erminea, raccoon-dog Nyctereutes procyonoides, muskrat Ondatra zibethicus and beaver Castor fiber (introduced in 1936-1954), jungle cat Felis chaus and wild pig Sus scrofa. Birds, with over 260 species recorded, of which 106 species breed, are especially numerous (with counts of 3,500 pairs of egrets, 4,000 pairs of herons 3,000 pairs of mute swans, 12,000 pairs of grey geese, 12,500 pairs of duck and 200,000 pairs of coots) including white and Dalmatian pelicans Pelecanus onocrotalus and P. crispus and cormorants and pygmy cormorants Phalacrocorax carbo and P. pygmaeus, many heron species such as the egrets Egretta alba and E. garzetta, the squacco heron Ardeola ralloides, grey and purple herons Ardea cinerea and A. purpurea, as well as night heron Nycticorax nycticorax, glossy ibis Plegadis falcinellus and spoonbill Platalea leucorodia, mute and whooper swans Cygnus olor and C. cygnus, greylag goose Anser anser, black and whiskered terns Chlidonias nigra and C. hybrida and the common tern Sterna hirundo. Raptors include breeding white-tailed eagle Haliaeetus albicilla, osprey Pandion haliaetus hobby Falco subbuteo and red-footed falcon Falco vespertinus. The area is on a major flyway with 40-50,000 birds on passage, and 400,000 ducks moulting in the delta. The large fish population with up to 56 species recorded include pike Esox lucius, carp Cyprinus carpio, catfish or eels Siluris glanis, perch Perca fluvitilis and the zander or pike-perch Stizostedion lucioperca.

ZONING/CONSERVATION MANAGEMENT In 1976 an area of 650,000ha was declared a Ramsar Wetland named Volga Delta. There are core areas within the three sections respectively covering 260ha (Damchiksky) 940ha (Trekhizbinsky) and 4,254ha (Obzhorovsky), with each sector surrounded by a buffer zone. There are plans for a fourth sector due south of Trekhizbinsky which would be entirely marine. The area is under reserve management and activities within the surrounding areas of the core zones are restricted. The hydrological regime of the Volga River is regulated further upstream in order to reduce flood levels and flood durations which has in the past affected the productivity, species composition and species numbers in the ecosystem. One kilometre wide marginal zones are mown for fire prevention.

STAFF 144 with 45 researchers of ten distinct disciplines

LOCAL ADMINISTRATION Astrakhanski Zapovednik, Quay of the River, Tsarev 119, 416605 Astrakhan.

VISITOR FACILITIES There are no tourist facilities and visits are limited to one day organized excursions.

SCIENTIFIC RESEARCH AND FACILITIES A hydro-meteorological station has been in operation for over 30 years and each of the three sectors of the reserve has laboratories and floating observatories for data collection. Research is conducted in close association with the USSR Academy of Sciences, with major research being conducted on the effect of the large hydrological projects and economic development on the delta. Annual inventories are taken on the main species of protected animals, this being done with the use of aircraft. More than 200,000 birds have been ringed (20-30,000 annually).

LOCAL POPULATION No settlements are present in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Some former species of fauna have become extinct, but the area is largely in a natural state and contains no roads or human settlements. Owing to the continuing drop in the water level of the Caspian Sea, and the regulation of the flow of the Volga River, the delta's islands and deposits have moved 40-50km downstream, and many of the important waterfowl populations are beyond the reserve boundaries.

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Kronotskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.07.05 (Kamchatkan)

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1934. Approved as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION On the east coast of the Kamchatka peninsula. 170km north-east of Petropavlovsk-Kamcahtskiy in the Elizovsky district of the Kamchatka Oblast', stretching from the Kamchatskiy Bay to the north of the Kronotskiy Peninsula south to the shores of Kronotskiy Bay. 54°9'-55°07'N, 159°38'-162°07'E.

ALTITUDE 0-3528m

AREA 1,099,000ha

LAND TENURE State owned

PHYSICAL FEATURES The reserve includes 606,722ha of forests, 31,534ha of water areas (including Lake Kronotskiy) and a 135,000ha coastal sea zone. The rugged coastal mountain range of the Kronotskiy Peninsula with its 1400m high mountains includes numerous extinct and active volcanoes, geysers, thermal lakes and springs, all resulting from widespread vulcanism. The region also has glaciers such as the eight kilometre long Tyushevsky Glacier. Basalt rock flows are widespread. Soils are podsolic, tundra gley and peat. The climate is marine and due to the influence of the ocean, mean temperature varies from -8°C on the coast in January to 12°C, in July, with 160-200 days with temperatures below 0°C. Total rainfall is 1000mm annually.

VEGETATION There is vertical zonation: marine coast (wet and dry tundras, with thickets of lyme grass and tall herbaceous vegetation); forest and brush starting at 800m (parkland type Russian rock birch Betula ermanii stands with tall herbaceous vegetation); alder Alnus sp. and Korean pine Pinus koraiensis forests with mountain ash Sorbus aucuparia, alder and honeysuckle Lonicera sp. understorey. The river valleys have tall forests of willow Salix sp., alder Alnus sp. and Mongolian poplar Populus sp. Other communities include dwarf shrub moss and lichen tundras, a relict stand of fir Abies sp. on the lower reaches of the Staryi Semlyachik, and a stand of larch Larix sp. At elevations of 800-3500m there is treeless high mountain volcanic tundra with poor vegetation. Russian rock birch Betula ermanii forest, dwarf birch Betula pumila, scrub and crowberry Empetrum nigrum are characteristic of both the mountain and coastal tundra, as are thickets of grasses such as Calamagrostis and of meadowsweet Filipendula. The flora totals 800 species.

FAUNA Thirty-three species of mammals and 179 species of birds have been recorded. Komchatka sable Martes zibellina is ubiquitous, and ermine Mustela erminea and wolverine Gulo gulo are common as are brown bear Ursus arctos and otter Lutra lutra in some years. The tundra is inhabited by northern pika Ochotona hyperborea, marmot Marmota kamtschatica, arctic ground squirrel Citellus undulatus, reindeer Rangifer tarandus and big horn sheep Ovis canadensis. Rodents are common and bats are represented by Myotis mystacinus. There are Steller's sea lion Eumetopias jubatus, ringed seal Phoca hispida and sea otter Enhydra lutris in coastal waters. Numerous geese, duck and swans, including whooper swan Cygnus cygnus, bean goose Anser fabilis, and pintail Anas acuta, amongst others breed in the area and visit it on migration. The forests and coasts have Siberian capercaillie Tetrao parvirostris, willow grouse Lagopus lagopus and white-tailed eagle Haliaeetus albicilla and Steller's sea eagle H. pelagicus. Salmon Oncorhynchus spp spawn abundantly in the rivers.

ZONING/CONSERVATION MANAGEMENT The biosphere reserve is 1,099,000ha. The reserve was originally 1 million ha, increased to 1,217,000ha in 1950 but decreased to 964,000ha in 1967. In November 1982 its size was increased to 1,099,000ha, which includes a five kilometre coastal marine zone. A strict conservation zone has been set up to protect the populations of sea otter Enhydra lutris and other marine mammals, and a zone for the large ungulate tundra mammals. Established originally for the protection of the valuable Kamchatka sable. There is no zoning; this is entirely a Strict Nature Reserve.

STAFF Sixty-eight including seven researchers and 37 wardens

LOCAL ADMINISTRATION 68010 Elisovo, Kamchatka Region, Ulitsa Ryabchikova, 48.

VISITOR FACILITIES A number of limited tourist trails have been set up

SCIENTIFIC RESEARCH AND FACILITIES A network of stations has been established for integrated long-term research by permanent staff based at the reserve and with joint projects of the Institute of Volconlogy, Far Eastern Research Centre, USSR Academy of Sciences and the Kamchatka Department of the Pacific Research Institute of Fisheries (TINRO), and the Kamchatka Board for Hydrometeorology and Control of the Natural Environment. There is equipment, a laboratory and a volcanological research station. There are three major projects; nature inventory, ecosystem complexes of the volcanic ranges of the middle Komchatka with particular reference to the relict stands of fir and larch, and the role of ungulates and the larger predators.

MODIFICATION OF THE NATURAL ENVIRONMENT In the past there was over-exploitation of marine mammals, fur-bearing mammals and the populations of ungulates. This is now strictly controlled.

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Laplandskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.03.03 (West Eurasian Taiga)

LEGAL PROTECTION Total

DATE ESTABLISHED Declared a reserve in 1930. Approved as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION Situated in the Monchegorsk District of Murmansk Oblast' in the western part of the Kola peninsula and immediately west of lakes Imandra and Moucha, 116km south of Murmansk, and 58km north of Kandalaksha. It lies 120-160km north of the Arctic Circle. 67°10'-68°05'N, 31°45'-32°45'E.

ALTITUDE 470-1115m

AREA The biosphere reserve is 278,400ha, but the strict reserve was given as 161,300ha now 161,254ha.

LAND TENURE State owned

PHYSICAL FEATURES An area of plains and low mountains, with glaciated landforms and exposures of the crystalline gneissose granites of the Baltic shield. The lowlands are filled with boulder-sand moraine deposits and soils which are largely podzolic poor and boggy. The upland areas have tundra

soils. There are permafrost patches in the mountains but the climate is moderated by the influence of the Atlantic Stream with temperatures ranging from -14°C to 24°C with 220 days annually below 0°C. Total annual rainfall is 400mm, but the low evaporation rate is conducive to swamping. Polar nights last 25 days and the 'white nights' season 100 days.

VEGETATION Habitats present are forests (53% of area), mountain tundra (28%), mountain slope birch woodland (7%), mires (7%) and rivers and lakes (5%). The dominant forest species are pine Pinus sylestris, spruce (both Picea abies and Picea obovata) and birch Betula versucosa and B. pubescens. Characteristic associations are pine-reindeer moss (Cladonia sp.) with a berry understorey and spruce-birch woodland. At elevations above 300m and 450m there is mountain lichen tundra with willow Salix polaris, mountain avens Dryas octopetala and Rhododendron lapponicum. Yellow water lily Nuphas lutea occurs on the lakes.

FAUNA Mammals include beaver Castor fiber (reintroduced in 1934 and now with a population estimated at 50) lemming Lemmus lemmus, brown bear Ursus arctos, pine marten Martes martes, wolverine Gulo gulo, otter Lutra lutra, about 50 elk Alces alces and 20,000 reindeer Rangifer tarandus. Birds include several species of raptors such as osprey Pandion haliaetus, golden eagle Aquila chrysaetos, white tailed eagle Haliaetus albicilla, gyr falcon Falco rusticolus and hawk owl Surnia ulula; gamebirds such as willow grouse and ptarmigan Lagopus lagopus and L. mutus, capercaille Tetrao urogallus, black grouse Lyrurus tetrix, and hazel hen Tetrastes bonasia, are all present, as are typical eastern palaearctic species such as the Siberian tit Parus cinctus and Siberian jay Perisorus infaustus. Breeding waterfowl include six species of duck and whooper swan Cygnus cygnus and bean goose Anser fabalis. The rivers and lakes hold up to 13 species of fish.

ZONING/CONSERVATION MANAGEMENT There are two strict protection zones and a protective belt of 15,600ha. The area is managed as a strict reserve.

STAFF Seventy-four including eight researchers and 35 wardens

LOCAL ADMINISTRATION Laplandskiy State Reserve, 184280, Monchegorsk, Murmansk Region, Zelenyiper 8.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has been taking place since 1930 with major investigations into mountain taiga ecosystems, mountain tundras, lakes of the Kola Peninsula and the ecology of the Kola populated reindeer, as well as on fur-bearing animals and fish. Man's impact on various ecosystems and the successional stages after fire have been researched. There is a laboratory and scientific equipment.

MODIFICATION OF THE NATURAL ENVIRONMENT Major threat to the site is from pollution caused by waste from a large industrial plant in the eastern part of the reserve. Forest fires have affected about 10% of the area in the past, and logging took place over a further 7% of the area. Muskrat Ondatra zibethicus were introduced in 1931 and American mink Mustela vison, accidentally, in 1958.

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Pechoro-Ilychskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.03.03 (West Eurasian Taiga)

LEGAL PROTECTION Total

DATE ESTABLISHED Reserve created in 1930 and approved as a Biosphere Reserve in 1984

GEOGRAPHICAL LOCATION The reserve is situated in the Troitsko-Pechorsk Region of the Komi Autonomous SSR on the western slopes of the Northern Urals, bounded to the east by the Poyasovyy Kamen' Range of mountains, by the river Pechora to the south and the river Ilyoh to the north and west. It lies in two sections 41km apart and approximately 300km south-east of Uchta and 240km south of Pechora. 61°43'-63°15'N, 56°49'-59°38'E.

ALTITUDE 150-1195m

AREA Reserve is 721,322ha; the Biosphere Resrve 721,300ha

LAND TENURE State owned

PHYSICAL FEATURES The south central part of the reserve lies on the Pripechova lowlands, a vast plain of sand and morainic loam at the foot of the North Urals and traversed by the Pechora river and its tributary the Ilych both of which rise near the summit ridge of the Ural chain. To the north and east there are rolling foothills which rise to the Ural mountains in the east. A mean January temperature of -17°C, July temperature 12°C to 20.5°C with 180-200 days below freezing point. Rainfall is estimated at 500mm to 550mm annually. Snow cover, upto 100cm deep is present for a period of seven months.

VEGETATION The reserve is 87% forested (624,570ha) with 1,567ha of water bodies. The lowlands have pine forests and marshes which give way to the larch dominated foothills and mountains which at higher altitudes have subalpine scrub woodlands, meadows, tundras and bear rock areas. The lowland areas are predominantly forests of pine Pinus sylvestris and larch Larix sibirica in higher areas. Ground cover consists of cowberry Vaccinium vitis-idaea, bilberry V. myrtillus and reindeer mosses Cladonia spp. whilst wetter areas have Sphagnum moss with cranberry Vaccinium oxycoccus. Valleys have extensive forests of spruce Picea abies, fir Abies sibirica and pine Pinus sylvestris. The flood plain islands and terraces have bushy meadows, with willow Salix spp., rowan Sorbus aucuparia, blackcurrant Ribes nigrum and bird cherry Prunus padus being the dominant tree and shrub species. The subalpine meadow plants include Anemone sp., Paeonia sp., the Umbellifer Pleurospermum uralensis, Myosotis sp. and Geranium sp., whilst Saxifraga sp., Dryas sp. and Thymus sp. of the tundra.

FAUNA The fauna includes both European and Asiatic species with 43 mammal species including hare Lepus timidus, squirrel Sciurus vulgaris, flying squirrel Pteromys volans, beaver Castor fiber (reintroduced), wolf Canis lupus, fox Vulpes vulpes, brown bear Ursus arctos, Mustela spp., otter Lutra lutra, pine marten Martes martes, sable M. zibellina, wolverine Gulo gulo,

lynx Felis lynx, and elk Alces alces. The musk rat Andatra zibethicus has been introduced into the area. The 205 bird species recorded include capercaillie Tetrao urogallus, black grouse Lyrurus tetrix, willow grouse Lagopus lagopus, hazel grouse Tetrastes bonasia, black woodpecker Dryocopus martius, three-toed woodpecker Picoides tridactylus, nutcracker Nucifraga caryocatactes and red-flanked bluetail Tarsiger cyanurus. A number of waterfowl species including goldeneye Bucephala clangula, goosander Mergus merganser, wigeon Anas penelope, teal Anas crecca and bean goose Anser fabalis breed in the area. The 16 fish species include salmon Salmo salar, grayling Thymallus arcticus and whitefish Coregonus spp.

CULTURAL HERITAGE The hills of this region hae traces of Paleolithic camp sites and fossil remains.

ZONING/CONSERVATION MANAGEMENT The reserve is split into two sections 41km apart. The larger mountain zone (705,500ha) to the north-east of the 15,800ha lowland zone is near Yaksha. Strict regime zones have been set up.

STAFF 78, including 12 researchers and 32 workers

LOCAL ADMINISTRATION 169 436, settlement Yaksha, Pechoro-Ilychsky District, Komi, ASSR.

VISITOR FACILITIES Access is restricted

SCIENTIFIC RESEARCH AND FACILITIES There are research stations and permanent sample plots and the inventory of natural objects has been maintained since 1946. In 1949 an experimental farm was established for conducting research into the breeding of domesticated elk. During 1981-1985 research dealing with five project areas was planned: general nature inventory, inventory of vascular plants, the biology of salmon and grayling in the Pechora river basin, population ecology of capercaillie and hazel hen and the maintenance, breeding and selection of moose in nursery conditions. Other work has in the past been conducted on Martes zibellina. The reserve conducts long-term research in association with the Komi Branch of the USSR Academy of Sciences.

MODIFICATION OF THE NATURAL ENVIRONMENT Practically none

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Sayano-Shushensky Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.35.12 (Altai Highlands)

LEGAL PROTECTION Total

DATE ESTABLISHED Established by decision of the Council of Ministers RSFSR in 1976 as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION Located in the Shushenski and Ermakovski rayons of Krasnoyarski Kraj in south central RSRSR, on the left bank of the Enisey River,180km south of Abakan, 470km south of Krasnoyarsk and 900km west of Lake Baykal. 52°04'N, 91°51'E.

ALTITUDE 400-2,735m

AREA Total area of 389,570ha

LAND TENURE State owned

PHYSICAL FEATURES The reserve has a typical western Sayana landscape, with most of the area lying between 1,500-2,000m and rising to several peaks above 2,500m. The slopes of the mountains are very bare as are the upland zones and the bottoms of the river valleys which have boulder areas and bare rock faces. The Sayanski Ridge acts as a divide between the arctic influences from the north and the central asiatic influences to the south resulting in dry conditions on one side and unusually heavy snowfalls (upto 2m deep) on the other. There is a dense network of streams and rivers and the Enisey lies in a deep trough. The result of the construction of the Sayano-Shushenski hydro-electric scheme is a deep and narrow reservoir, in places forested to the water's edge and in others with cliffs. The other major rivers, the Golaya and the Bol'shiy Ury lie in the south and have strong currents and rarely freeze in the winter.

VEGETATION In the reserve 59% is covered by forests and 36% by bare rocky terrain and scree slopes. The reserve lies on the boundaries of several botanical regions and hence the flora is of a mixed character, with many endemics and relict species, of trees, shrubs and flowers (e.g. Krylov's wheat grass, Borodin's columbine, Enisei anemone, Baikal anemone). The northern parts of the reserve are characterised by coniferous and mixed forest, extending from the river valleys to a height of 800-1,000m and Korean pine Pinus koraiensis and fir extending higher to 1,800m, but generally with pure stands of Pinus koraiensis above 1,200m. The subalpine zone with dwarf pines occurs between 1,500-1,800 merging with subalpine meadows and tundra-vegetation at 2,100m where grasses reach a height of 150-180cm. In the southern parts the vegetation is more simply structured and the zonation boundaries lie higher, with conifer forest extending from 700-1,200m, and steppe habitat appearing below this.

FAUNA There is a rich mixture of species representing Altay, Mongolian and Sayan fauna with many rare and endangered species, such as Siberian red dog Cuon alpinus, Siberian ibex Capra ibex and lesser long-tailed hamster Cricetulus longicaudatus. Other mammals include brown bear Ursus arctos, elk Alces alces, lynx Lynx lynx, and the southernmost mountain-taiga form of the reindeer Rangifer tarandus, wolf Canis lupus and wolverine Gulo gulo. Birds species include the Altai snowcock Tetraogallus altaicus.

ZONING/CONSERVATION MANAGEMENT On the right hand bank of the Enisey River, along the northern and eastern boundaries of the reserve and along the Sayano-Shushenski Hydroelectric Reservoir there is a two kilometre wide protective belt with a zakaznik status. A protective zone of 30,000ha has been established. There exists a real possibility in the reserve to protect and increase the only population in the RSRSR of the Siberian Goat, where there is sufficient area to allow for seasonal migrations. The gathering of medicinal plants in the reserve is prohibited, which safeguards 'maral root' Maraly koren and 'golden root' Zolotoi koren.

STAFF 103, with eight researchers and 51 wardens

LOCAL ADMINISTRATION Krasnoyarskiy kray, Shushenskiy rayon, 662720 pos. Shushensko, Pioneerskiy proezd, d.1.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research is also being conducted into the natural complexes of the southern Siberian mountains for the purposes of intensifying the use of the natural resources. The effect of the reservoir on the reserve is being recorded by three monitoring stations specifically set up for the purpose in 1981-1982. They record geobotanical, theriological, ornithological and microclimatic features. The resource has scientific facilities and a network of stations and permanent sample sites. Current research is on a nature inventory, an inventory of the flora, avifauna and mammals and the role of ungulates and big predators in the ecosystem.

MODIFICATION OF THE NATURAL ENVIRONMENT The reservoir thus created, began to be filled in 1978 to be completed by 1985. It was reported in 1985 that the reserve was threatened by the construction and functioning of a hydro-electric power station.

PRINCIPAL REFERENCE MATERIAL

Borodin, A.M. and Syroechkovski, E.E. (1983). Zapovedniki SSSR. Moskva 'Lesnaya Promyshlennost''.

Sokhondinskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.30.11 (Mongolian-Manchurian Steppe)

LEGAL PROTECTION Total

DATE ESTABLISHED Reserve was created in 1973 and approved as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION Situated in the Kyrinsky district in the south-west of the Chita Oblast', 47km west of Kyra 25km north of the Mongolian border and 400km south-east of Lake Baikal. 49°29'-50°0'N, 110°33'-111°22'E.

ALTITUDE 700-2508m

AREA Biosphere reserve is 211,000ha, the zapovedniki is given as 210,986ha.

LAND TENURE State owned

PHYSICAL FEATURES The reserve (which is roughly rectangular measuring 20km by 14km) occupies the isolated mountain massif of Sokhondo (2508m) which is the highest part of the Khente-Chkoi plateau and is the source of at least nine main rivers including the Ingoda, Bakukun, Agutsa and the Great Burecha, all of the Baikal-Amur watershed. This mountainous area is characterized by alpine relief with numerous streams and rivers flowing though steep sided forested valleys. Cryomorphic soils are widespread. Below 1000m there are mountain cryomorphic sod-taiga soils, between 1000-1200m and 1400-1600m they are loose structured montane and moderately podsolized soils, and above this there are mountain cryomorphic taiga soils. The climate is continental, with

Pacific monsoon elements in the summer (with 80% of total annual rainfall falling in July and August) and at high altitudes soil frosts and snow cover (average depth 53cm) persist throughout the year. Mean annual temperature is -2.9°C.

VEGETATION There is a series of altitudinal vegetation belts, with a steppe zone (upto 11-6m), a light-conifer taiga zone (upto 1620m) with larch and pines a dark-conifer taiga zone (upto 1940m) with Korean pine Pinus koraiensis, fir and spruce. Dominant tree species include Pinus sylvestris, P. sibirica, P. pumila and Larix daurica. Upto 2,114m there are alpine meadows with stunted woodlands of Korean pine and above this high mountain tundra. The alpine meadows have a number of rare species such as the edelweiss Leontopodium sp., pasque flower Pulsatilla sp., lilies Lilium sp. and day lilies Hemerocallis sp. A small area of steppe vegetation has a variety of tansy Tanacetum sibirica.

FAUNA There are records for 40 species of mammals and 125 species of birds. Steppe area and the higher mountain regions have long-tailed souslik Spermophilus undulatus, a marmot-like animal, as well as hare Lepus capensis, corsac fox Vulpes corsac, mountain weasel Mustela altaica, and Siberian jerboa Stylodipus sp. Larger mammals are numerous and include the brown bear Ursus arctos, lynx Lynx lynx, wild boar Sus scrofa, musk deer Moschus moschiferus, Manchurian deer Cervus elaphus xanthropygus, roe deer Capreolus capreolus pugargus, sable Martes zibellina and elk Alces alces. Birds include the Siberian capercaillie Tetrao parvirostris, willow grouse Lagopus lagopus and the hazel grouse Tetrastes bonasia.

ZONING/CONSERVATION MANAGEMENT There area no strict protection areas designated nor is there a protective zone.

STAFF 70 with eight researchers and 34 wardens

LOCAL ADMINISTRATION 672 674250, Kyra, Chita region, Gorkyulica, 48.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There are long-term monitoring stations, permanent sampling and ecological plots set up. The main research is towards compiling an inventory with special reference to mosses, lichens, birds and mammals.

MODIFICATION OF THE NATURAL ENVIRONMENT Forest fires present a natural threat, and some poaching occurs.

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Voronezhskiy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.11.05 (Middle European Forest)

LEGAL PROTECTION Total

DATE ESTABLISHED Declared a reserve in 1927 by Act of the People's Commissars and approved in 1977. Accepted as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION In the central part of the East European Plain, split between the Lipetsk Oblast' and the Voronezh Oblast', Verhekhavsky and Urman districts, to the east of the Voronezh River, 35km north-east of Voronezh and 450km south-east of Moscow 52°0'N, 39°41'E.

ALTITUDE 90-170m

AREA 31,053ha

LAND TENURE State owned

PHYSICAL FEATURES It comprises an undulating plain, sloping to the west, and crossed by the Usman' and Ivnita rivers and their tributaries. Geologically the area consists of sandy deposits 0.5 to 3m thick, of fluvio-glacial origin which give rise to soils which are wet and podsolic and occasionally form mounds some 6-7m high. Mean temperatures range from 20°C in July to -10.6°C in January with 140 days below 0°C and mean annual temperature of 4.8°C. Mean annual rainfall is estimated at 589mm.

VEGETATION The site occupies the northern part of the Usmanski Forest which is one of the largest forest areas in the steppe and is a mixed forest with stands of pine Pinus sylvestris, pines with oak Quercus robur, stands of oak with a lime understorey Tilia cordata and flood plain forests of alder Alnus glutinosa. Other tree species include aspen Populus tremula, birch Betula pendula, ash Fraxinus excelsior, maple Acer campestris and rowan Sorbus aucuparia. Shrubs include Euonymus verrucosa and Cytisus ruthenicus. Of the 973 species of plants recorded (133 tree and shrub species) the more interesting include Molinia caerulea, Aegopodium podagraria, Carex pilosa, Poa nemoralis, lily-of-the-valley Convalaria majalis, and Asarum europeum.

FAUNA Fifty-four mammal species present include Russian desman Desmana moschata, beaver Castor fiber, otter Lutra lutra, elk Alces alces. A total of 187 bird species have been recorded including saker falcon Falco cherrug, short-toed eagle Circaetus gallicus and osprey Pandion haliaetus. Some 39 species of fish, eight species of amphibians and eight species of reptiles and over 6,000 invertebrate species are present.

ZONING/CONSERVATION MANAGEMENT Of the reserve area 28,481ha is forest, 535ha is meadow and 121ha is water, and there is a designated core area which includes the habitats of the rarer species. Managed as a Strict Nature Reserve with the core area free from farming, and overall entry. Reafforestation of the river banks (with willow Salix sp.) has enabled the beaver population to increase and the forest has recovered its primary structure. Wolves have been exterminated in an attempt to build up the herds of deer.

STAFF 277 of which 71 are engaged in research, 58 wardens and 115 support staff

LOCAL ADMINISTRATION 39 4047 Voronezh, Grafskaya Station, Voronezhsky Reserve p.o. Krasnolesnyy.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has been systematically conducted for the past 55 years with some records dating from 1936. Topics of current research include the relationships between soil fauna and plant growth and development, bryophytes, ecology of Coleoptera Adephage, parasitic worms of mammals and birds, a comparative analysis of the efficiency of breeding Canadian and European beaver, oak and aspen development. There are plans to obtain more sophisticated equipment and employ five more researchers. There are well equipped laboratories, a scientific library, a beaver research station and a hydro-meteorological station. There are plans for expansion both in the research programme and in staff numbers.

MODIFICATION OF THE NATURAL ENVIRONMENT Prior to its establishment as a reserve the site was heavily logged and the numbers of the larger mammals were reduced, particularly those of beaver (24-36) otter, wild boar and elk.

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Zharkov, O. V. (1972) The Voronezhsky State Reserve. Voronezh.

Tsentral'nolesnoy Zapovednik

BIOGEOGRAPHICAL PROVINCE 2.10.05 (Boreonemoral)

LEGAL PROTECTION Total

DATE ESTABLISHED Decreed under Act of Council of People's Economy in May 1930, created by Act No. 1303 of Council for People's Economy December 1931 and present boundaries established by Act of the Council of Ministers in February 1960 (No. 369p.). Approved as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION The reserve in the Nelidovsky District of the Kalinin Oblast', in the north-west of the Middle Russian uplands and the south-west section of the Valdayskaya Plateau, 280km north-west of Moscow and 25km north of Nelidovo. 56°30'N, 32°52'E.

ALTITUDE 200-289m

AREA 21,348ha

LAND TENURE State owned

PHYSICAL FEATURES The reserve lies in a gently undulating plain of glacial origin with a north-western trending slope and the highest moraine ridge lying in the south. The soils are predominantly podsolic and clays which give rise to bogs on the upland plateau from which run the rivers Zhukopa and Tyudma, tributaries of Volga and the river Mezha, a tributary of the West Dvina. It has a moderately continental climate with a temperature range from means of 18°C (July) to -8°C (January) giving a mean annual temperature of 3.6°C with 135 days below 0°C and 130 days with temperatures over 10°C. The mean annual

precipitation is 640mm with 40% falling in the summer months. The total precipitation considerably exceeds total evaporation and the hydrothermic index is 1.6 to 1.7.

VEGETATION The vegetation is typcal of the moraine landscape of the Central Russian Plain consisting of southern-taiga forest and considerable areas of oligotrophic sphagnum bogs with elements of hypoarctic flora. The forests are mixed Norway spruce Picea abies and fir with hazel Corylus avellana and lime Tilia cordata together with a ground flora of mosses, wood sorrel Oxalis acetosella, blueberry Vaccinium myrtillis and cowberry V. vitis-idaea. Lowland areas have a ground cover of bog moss Sphagnum spp. In total there are 540 species present.

FAUNA These are 51 mammal species and 171 bird species including beaver Castor fiber, wolf Canis lupus, brown bear Ursus arctos (12-14 individuals) pine marten Martes martes, lynx Lynx lynx (10-12) and elk Alces alces. The racoon dog Nyctereutes procyonoides was introduced in the 1930s at the same time as the beaver was re-introduced. Birds include capercaillie Tetrao urogallus, ptarmigan Lagopus lagopus and hazel hen Tetrastes bonasia. Cranes Grus grus nest in the bog areas.

ZONING/CONSERVATION MANAGEMENT The reserve has three zones: a strict protection zone, a research zone and a recovery zone (that is previously logged areas). The reserve is surrounded by a buffer zone 1km wide with restricted development, where use of toxic chemicals and logging is forbidden. Mineral prospecting is allowed only with authorization from the reserve administration. The area is managed on a strict nature reserve.

STAFF 92 including six administrative, 21 researchers, 31 forestry personnel and 20 logistic support. The permanent staff live in administrative buildings within the reserve.

LOCAL ADMINISTRATION 172513 Zapovednik, Nelidovsky District, Kalininsky Oblast'.

VISITOR FACILITIES No tourism nor general access. There are no tourist trails.

SCIENTIFIC RESEARCH AND FACILITIES Meteorological observations have been made since 1963. The five year research plan (1981-1985) aims at an integrated study of the ecosystems of primary and secondary forests. This work is being carried out in coordination with the Botanical Institute of the USSR Academy of Sciences and Moscow University. In total there are 12 research projects, four solely carried out by reserve staff: nature record inventory; baseline sample plots, ecological profiles for long-term studies of the dynamics of spruce populations and the monitoring of plant cover changes and structure of wildlife complexes, with special reference to human modification of adjacent landscapes. There are annual censuses of animal populations.

MODIFICATION OF THE NATURAL ENVIRONMENT The area was at the time of establishment of the reserve practically unmodified by man. During the temporary closure of the reserve (1951-60) an area of 454ha was logged, but this is now recovering its natural structure.

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Karpos, V. G. (1973). Collected papers on Structure and Production of Forests of the South Taiga. publ. Nauka, 1973.

Lake Baikal Region Biosphere Reserve: Baikal'skiy Zapovednik Unit

BIOGEOGRAPHICAL PROVINCE 2.04.03 (East Siberian Taiga)

LEGAL PROTECTION Total

DATE ESTABLISHED The reserve was established by order of the Council of Ministers RSFSR in 1969 (26 October N. 571). Declared a biosphere reserve in 1986. Twinned with Barguzinskiy State Reserve.

GEOGRAPHICAL LOCATION The southern terraces of Lake Baikal in Buryat SSR, and including the eastern part of the Khamar-Daban mountains, 170km west-south-west of Ulan-Ude and 100km across the lake from Irkutsk, RSFSR. 51°50''N, 105°05'E.

ALTITUDE 650-2,323m

AREA Total area of 200,500ha. The reserve covering 165,724ha is designated the core area. (Lake Baikal Region Biosphere Reserve has a total area of 559,100ha, and includes twinned Baikal'skiy State Reserve and Barguzinskiy State Reserve.)

LAND TENURE State owned

PHYSICAL FEATURES The reserve has 117,214ha of forest and 1,552ha of water bodies. The south of the reserve is cut off from the northern part by the flat topped Khamar-Daban range running on an east-west axis, which slopes precipitously down to Lake Baikal from its highest point at Sokhor Mountain, 2323m. The north facing slopes are cooler and wetter, and snow covered in the winter while the southern slopes are drier and continental in character. Soils are of a mountain tundra type, varied locally by wet podzolic soils and chestnut meadow soils. The northern slopes have cirques and deep valleys with lateral ridges which extend to and into the lake shore forming rocky promontories. The mean temperatures range from -20°C in January to 16°C in July, remaining below freezing point for 180-210 days per year, with snowfalls upto 1m deep. Annual precipitation varies from 300 to 400mm.

VEGETATION Well marked zonation occurs. Sphagnum bogs and forests of poplar Populus and the monotypic willow-like Chosenia macrolepis occupy low-lying areas while the river valleys contain bird cherry Prunus padus, rowan Sorbus aucuparia and alder Alnus glutinosa. The northern slopes of the mountains have taiga of korean pine Pinus koraiensis, spruce Picea and cedar Pinus sibirica, with fir Abies sibirica dominant in places whilst the southern slopes are covered in mixed larch Larix sibirica and pine Pinus sp. forest which gives way to steppe vegetation on the foothills. At higher altitudes there is cedar elfin woodland and shrubs such as Rhododendron parvifolium with mountain tundra. The high altitude meadows support thickets of dwarf Siberian pine Pinus pumila and birch Betula middendorfii. In total there are 800 species of vascular plant recorded.

FAUNA Records exist for 37 mammal species and 260 species of bird. Mammals include brown bear Ursus arctos, sable Martes zibellina, mountain weasel Mustela altaica, steppe polecat M. eversmanii and kolinsky weasel M. sibirica, wolverine Gulo gulo, lynx Felis lynx, wild pig Sus scrofa, musk deer Moschus moschiferus, roe deer Capreolus capreolus, elk Alces alces and reindeer Rangifer tarandus. Birds include the swan goose Anser cygnoides, crested honey buzzard Pernis ptilorhyncus, black kite Milvus migrans, hawk owl Sunia ulula, rock ptarmigan Lagopus mutus, hazel grouse Tetrastes bonasia, capercaillie Tetrao urogallus and great bustard Otis tarda.

ZONING/CONSERVATION MANAGEMENT The core zone of thee strictly protected areas covers 165,700ha where all economic activity is prohibited and access is restricted. With the buffer zone of 34,800ha economic activity compatible with the preservation of the landscape is allowed. The core zone contains species of economic importance such as Sable and Engleman spruce. An area of 487ha is set aside for laboratories and administrative purposes. The local populaton do not participate in the management decisions governing the reserve.

STAFF The total staff is 79 including 42 employed in administration, control and resource management of which eight are university trained. There are 37 rangers.

LOCAL ADMINISTRATION Chief of Reserve 671120, Tankhoi, Kabanski district Buryat ASSR.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Studies of ecosystem changes of the terraces bordering southern Baikal and of the Khamar-Daban range have been made and there is monitoring of climate, vegetation, animal populations and their harvesting, as well as training and lecturing activities. Specific research is conducted on the conservation reproduction and management of sable. Research activity is coordinated by the Academy of Sciences. Facilities include a research station, a field station, experimental plots, a climatic station and overnight accommodation for scientists. Access is by railway to the Tankhoi station.

LOCAL POPULATION There are no human settlements

MODIFICATION OF THE NATURAL ENVIRONMENT There is a danger of fires. The presence of a railway line and highway along the northern boundary has an unknown effect on the natural ecosystem.

PRINCIPAL REFERENCE MATERIAL

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Borodin, A.M. and Syroechkovski, E.E. (1983). Zapovedniki SSSR Moskva. 'Lesnaya prom'shlennost''.

Lake Baikal Region Biosphere Reserve: Barguzinskiy Zapovednik Unit

BIOGEOGRAPHICAL PROVINCE 2.04.03/2.44.14 (East Siberian Taiga and Lake Baikal)

LEGAL PROTECTION Total

DATE ESTABLISHED Established by order of the Council of Ministers RSFSR in 1916 and verified by act of the Council for Peoples Economy on 4 January 1926, N. 513. Declared a biosphere reserve in 1986, twinned with Baikal'skiy State Reserve 400km to the south-west.

GEOGRAPHICAL LOCATION The reserve covers 100km of the north-eastern shore of Lake Baikal and extends 45-80km inlands to the western slope of the Barguzinskiy range, about 360km north-north-east of Ulan-Ude, RSFSR. 54°20'N, 109°45'E.

ALTITUDE 400-3,000m

AREA Total area of 358,600ha with a core zone consisting of the reserve proper amounting to 263,176ha. (Lake Baikal Region Reserve has a total area of 559,100ha, and includes twinned Baikal'skiy State Reserve and Barguzinskiy State Reserve.)

LAND TENURE State owned

PHYSICAL FEATURES The reserve includes a 100km long and 3km wide stretch of the Baikal shoreline, (15,000ha in total) its adjacent waters and also part of the summit ridge of the Barguzinskiy range. The mountainous section is almost inaccessible, being very deeply dissected, with numerous glacial cirques, corries and lakes, these being the sources of mountain torrents. The climate is severe, with 210 days below freezing point and a mean January temperature of -26°C, although average winter temperature is -20.8°C and average annual temperature is 4.6°C. The lake is frozen for five months of the year. The mean July temperature is 12-16°C. Precipication is on average 470mm annually. The climate in the west of the reserve is moderated by the influence of the lake, with cooler summers and milder winters, the water temperature seldom exceeding 12°C. Noteworthy are the many hot springs (40-78°C) present in the reserve.

VEGETATION Terraces near the shore have larch Larix dahurica and Rhododendron dahuricum; grading into the more fertile mixed fir-Korean pine Pinus koraiensis taiga and larch forests of Pinus sibirica and Larix sibirica, with some spruce Picea obovata, the monotypic willow Chosenia macrolepis, with an understorey of honeysuckle Lonicera periclymenum, rowan Sorbus aucuparia and currants Ribes rubrum and R. nigrum. At higher altitudes there is pure fir Abies sibirica and 'cedar' Pinus sibirica forest, followed by thickets of dwarf pine Pinus pumila and finally, at the highest levels, Kobresia dominated tundra, peaty meadows with sedges Carex spp., Betula ermanii on stony talus and lichen Cladonia and Cetraria covered rocks and cliffs. The hot springs support relict species from warmer climates such as violets Viola spp. In total 600 species of vascular plants have been recorded.

FAUNA This is characteristic of the taiga with 39 species of mammal recorded include pika Ochotona hyperborea, Siberian chipmunk Eutamias sibiricus, marmot Marmota baibacina, flying squirrel Pteromys volans, fox Vulpes vulpes, brown bear Ursus arctos, stoats and weasels Mustela altaia, M. erminea, M. nivalis and M. sibirica, otter Lutra lutra, large numbers of a sable subspecies Martes zibellina princeps, wolverine Gulo gulo, the endemic Baikal hair seal Phoca sibirica, a local race of musk deer Moschus moschiferus, Siberian red deer Cervus elaphus sibiricus, elk Alces alces and reindeer Rangifer tarandus. The avifauna include 243 bird species, among them the white-tailed eagle Haliaeetus albicilla, capercaillie Tetrao urogallus. The lake contains some 50 species of fish including endemic deep water species.

ZONING/CONSERVATION MANAGEMENT The reserve consists of a core zone of 263,200ha and a buffer zone of 95,400ha. The reserve was specifically established for the conservation of the Barguzin sub-species of the sable Martes zibellina princeps.

STAFF Eighty-nine including 18 administrative, control and reserve management personnel, two Ph.D and five university trained scientists.

LOCAL ADMINISTRATION Chief of Reserve, 671715 Davshe Severo-Baikalsky district, Buryat ASSR.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has been conducted since 1957 and coordinated by the Academy of Sciences and in addition to a research station a monitoring station was set up in 1983 together with control plots, ecological profiles and transects for the monitoring of climate, vegetation, animal populations and their harvesting. Some lecturing is also carried out.

MODIFICATION OF THE NATURAL ENVIRONMENT Risk of forest fires, especially near the western boundary.

PRINCIPAL REFERENCE MATERIAL

Anon. (1959-1978). Proceedings of Barguzinsky reserve issues 1-7, Ulan-Ude.
Borodin, A.M. and Syroechkovski, E.E. (1983). Zapovedniki SSSR Moskva. 'Lernaya prom'shlennost''.

Beinn Eighe National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.31.12 (Scottish Highlands)

LEGAL PROTECTION Fully protected as a National Nature Reserve.

DATE ESTABLISHED 1968 as under the National Parks and Access to the Countryside Act 1949; further protected under the Wildlife and Countryside Act 1981; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION West coast of northern Scotland, in Wester Ross; 57°30'-57°39'N, 5°18'-5°30'W.

ALTITUDE 0-1,053m

AREA Nature Reserve: 4,758ha; Biosphere Reserve: 4,800ha

LAND TENURE 4,288ha are owned by the Nature Conservancy Council; the remaining 600ha are managed under a Nature Reserve Agreement with the owners.

PHYSICAL FEATURES This mountainous area has five peaks over 1000m joined by narrow ridges and borders Loch Maree to the north-east. It is part of the stable foreland west of the Moine Thrust composed of Lewisian gneiss cut by igneous dykes, underlying the mountains of Torridonian sandstone and Cambrian quartzite. These rocks have been faulted and subjected to minor thrusts. Severe glacial erosion has carved the mountains into arêtes and peaks with steep cliffs and corries (cirques), leaving little soil or drift, but screes occur at the foot of many steep slopes. Drainage is radial. Climate is cool temperate oceanic and moist, precipitation about 2500mm annually and the winds strong.

VEGETATION The most notable feature is a relict forest beside the Loch Maree on the north-east slopes below 400m of native Scots pine Pinus sylvestris and there are fragments of oak-birch forest with Betula pubescens and rowan Sorbus aucuparia. Most of the lowland area is a complex of wet heath with purple moor grass Molinia caerulea, cotton grass Eriophorum angustifolium, bog myrtle Myrica gale and ling Calluna vulgaris with bryophytes such as Hylocomium splendens and Sphagnum imbricatum. Montane areas have herb-rich dwarf shrub heath, especially of Calluna vulgaris-dwarf juniper Juniperus communis nana, bearberry Arctostaphylos uva-ursi, together with other ericaceous plants including blueberry Vaccinium myrtillus, cowberry V. vitis-idaea, cross-leaved heath Erica tetralix and alpine bearberry Arctous alpinus. Small outcrops of dolomitic mudstone support herb-rich grassland with bent Agrostis spp., sheep's fescue Festuca ovina and sweet vernal grass Anthoxanthum odoratum. The bryophyte and lichen fauna is of special interest. Some northern Atlantic liverworts, usually found on treeless hills, occur within the limit of woodland, including the conspicuous leafy liverwort Herberta borealis, known elsewhere only from Norway.

FAUNA Habitats include sea, freshwater, moorland, bog and woodland but the fauna is relatively sparse although representative of West Highland deer country. The pine marten Martes martes and wild cat Felis sylvestris are both rare species present but seldom seen. More characteristic mammals are mountain hare Lepus timidus and red deer Cervus elaphus with roe deer Capreolus capreolus in the woodland. Birds include occasional golden eagle Aquila chrysaetos, ptarmigan Lagopus mutus, peregrine falcon Falco peregrinus, but the avifauna is limited in species and numbers. A number of rare invertebrates are found in the woodland.

CULTURAL HERITAGE Pastoral people inhabited the nothern Higlands in pre-Roman times and 2,000 years of grazing, felling and burning have reduced the natural woodland to a few tiny relics.

ZONING/CONSERVATION MANAGEMENT None, but a zoned access scheme was initiated in 1972 in connection with red deer management. The reserve is bounded by extensive National Trust property which can act as a buffer zone and is part of the unofficial Gairloch Conservation Area, which is in turn part of a very extensive National Scenic Area. Management priorities are the restoration of woodland on lower ground and the preservation of montane habitats. The area has a deer management scheme. Access to some areas is restricted, particularly in Autumn. There are important opportunities for management, particularly of seminatural forest, in the wider Gairloch Conservation Area, surrounding the reserve.

STAFF Two wardens based at Kinlochewe and two estate workers

LOCAL ADMINISTRATION The Regional Officer (North West Scotland), The Nature Conservancy Council, Fraser Darling House, 9 Culduthel Road, Inverness, IV2 4AG.

VISITOR FACILITIES Access is restricted from 1 September to 21 November and advice is available from the wardens or Aultroy Visitors' Centre at Kinlochewe. There are two trails of 1.5km and 6.5km and a pony path, but hill walking equipment is advisable.

SCIENTIFIC RESEARCH AND FACILITIES This is an intensively studied site. Research has been carried out on: grazing for deer management, restoration of lowland woodlands and maintenance of montane habitats. An entomological survey has been carried out. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Clearance of the forest, often by burning, began centuries ago and has been carried out to assist grazing or to provide timber for iron smelting and boat building. In the past, there has been grazing by sheep, cattle, goats and deer, though only deer grazing has been widespread and is now the only grazing permitted. Potato cultivation in the past has left its mark and there has been and still is some drainage of peatlands. Visitor pressure is increasing, particularly in summer.

PRINCIPAL REFERENCE MATERIAL

A number of publications including trail and reserve publications by the Nature Conservancy Council are available from the Regional Office or Visitors Centre.

McVean, D.N. and Durno, S.E. (1959). Forest History of Beinn Eighe Nature Reserve. New Phytologist 58: 79-82.

Braunton Burrows National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED Established in 1964 as a Nature Reserve and accepted as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION On the north Devon coast in southwest England; 51°06'N, 04°12'W.

ALTITUDE 0-30m

AREA Biosphere Reserve: 596ha; Nature Reserve 604ha

LAND TENURE Privately owned. Sub-leased from the Ministry of Defence (which retains certain military training rights over 390ha) by the Nature Conservancy Council, which manages the area. The surrounding sand-dune system of 1140ha has been designated as a Site of Special Scientific Interest, part of which is leased as a golf course.

PHYSICAL FEATURES The reserve is part of Braunton Burrows, a complex, westward-facing system of dunes bounded in the north by the high land of Saunton Down and in the south by the estuary of the Taw and Torridge rivers. The system is just over 5km long on a north-south axis and over 1.7km wide, flanked on the west by the wide beach of Saunton Sands. On the seaward side the dunes are about 15m high, and other ridges behind them rise to over 30m in places. There is a mild oceanic climate.

VEGETATION The reserve is noted for the full sequence of foredune, stabilized dune and freshwater slack habitats, the latter supporting some of the plant species for which the area is well known. The club rush Holoschoenus vulgaris has flourished for over 250 years in the locality and its occurrence in Britain is only known from two other very small colonies. Other noteworthy plants are water germander Teucrium scordium, sharp rush Juncus acutus, shore dock Rumex rupestris, sand toadflax Linaria arenaria and sea stock Matthiola sinnata.

FAUNA The sand bars and ridges of the estuary in particular form important areas for wintering and migrant waders. There is a wide range of invertebrates present including many rare in Britain.

CULTURAL HERITAGE Sand mobility was greatly increased by military training between 1939 and 1945 but former buildings no longer survive. Grazing has left little mark, although cattle were once grazed all year round and a number of shelters, or linays, dotted the area of marshland.

ZONING/CONSERVATION MANAGEMENT The Ministry of Defence has some military training rights over 390ha. There are measures to reduce the damage from trampling by visitors including a boardwalk. Introduced sea buckthorn Hippophae rhamnoides is being controlled. A linay has been restored and a bird hide built. Nature walks are organised regularly, particularly for local schools.

STAFF One warden full-time plus voluntary wardens

LOCAL ADMINISTRATION The Regional Officer (South West Region), Nature Conservancy Council, Roughmoor, Bishop's Hull, Taunton, Somerset.

VISITOR FACILITIES The beach of Saunton Sands is popular with tourists. Access to the dunes is only restricted in the military area when flags are flying. A leaflet is available from the NCC at Taunton. There are information boards in car parks and an information centre planned in the village of Braunton. In 1985, 70 groups were guided around the reserve by staff. A road runs along the eastern edge of the reserve and there are two free car parks.

SCIENTIFIC RESEARCH AND FACILITIES Ways of reducing damage to the dune system and rehabilitating eroded areas are being investigated. Various aspects of the geomorphology, flora and fauna have been studied and species lists made.

LOCAL POPULATION None in the reserve; the area is backed by farmland but the town of Barnstaple is only about 10km to the east.

MODIFICATION OF THE NATURAL ENVIRONMENT The reserve has not been greatly modified by the past land use of grazing and rabbit production, except for small scale sea protection works to safeguard buildings including a lighthouse and lifeboat station, none of which still remain. Mobility of sand was greatly increased by military training 1939-45, but present military usage is generally compatible with conservation. Heavy recreational use, by visitors on foot, is probably more of a threat to the stability of the dunes. Invasion by introduced sea buckthorn Hippophae rhamnoides also threatens, but this is subject to current control measures.

PRINCIPAL REFERENCE MATERIAL
A guide leaflet has been published by the NCC.

Caerlaverock National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as a National Nature Reserve, with local bye-laws.

DATE ESTABLISHED 4 April 1957 as a National Nature Reserve under the National Parks and Access to the Countryside Act 1949, further protected under the Wildlife and Countryside Act 1981; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Southwest Scotland, Nithsdale district, Dumfries and Galloway region; 54°52'N, 3°30'W

ALTITUDE 0-10m

AREA 5501ha

LAND TENURE The reserve is owned privately and is managed by the Nature Conservancy Council under a Nature Reserve Agreement. A number of farmers hold agricultural tenancies over parts of the reserve.

PHYSICAL FEATURES This is one of the largest areas of unreclaimed saltmarsh in Britain of the northern type of silt over mud. The reserve includes saltmarsh, foreshore and freshwater. Rainfall is high and winds strong, and easterly movement of mud along the coast is taking place.

VEGETATION The main features are pioneer growth of Puccinellia maritima together with some of the most extensive red fescue Blysmus rufus populations in Britain, extensive Juncus gerardii marsh and good examples of the transition to brackish Phragmites communis marsh.

FAUNA The entire Spitsbergen population of barnacle geese Branta leucopsis with large numbers of pinkfooted geese Anser brachyrhynchus winter on the reserve. It is important in Scotland for pintail Anas acuta and thousands of

waders of up to 24 different species pass through. This is the most northerly recorded station in the British Isles for breeding natterjack toads Bufo calamita.

CULTURAL HERITAGE Wildfowling has been carried out for many years but is now restricted. Some drainage has occurred in the past.

ZONING/CONSERVATION MANAGEMENT There are several zones, including a sanctuary zone (6% of the area), a wildfowling and general access zone (3%) and foreshore zone. Parts of the sedge and rush area are grazed by cattle in summer but there is restricted access to the sanctuary area and wildfowling is not permitted on the foreshore. The Wildfowl Trust leases an adjoining 95ha of arable land which it manages as a wildfowl refuge.

STAFF One reserve warden, one temporary winter warden

LOCAL ADMINISTRATION The Warden, Tadorna, Hollands Farm Road, Caerlaverock, Dumfries and Galloway. The Regional Officer, The Nature Conservancy Council, South West Region, Scotland, The Castle, Loch Lomond Park, Balloch, Dunbartonshire G83 8LX.

VISITOR FACILITIES There is no admission to the sanctuary, but several access points to other areas are recommended. Information leaflets are available from the warden or watchtower. At the adjacent Wildfowl Trust refuge there are observation facilities and an exhibition.

SCIENTIFIC RESEARCH AND FACILITIES Research on barnacle geese is being carried out by the Wildfowl Trust on the reserve and adjoining arable land. Annual studies on the natterjack toad population are carried out by reserve staff. Work on erosion and accretion of the marsh has been carried out in the past. Wildfowl counts are made, as part of a national census. There is a high birdwatching tower.

LOCAL POPULATION None in the reserve

MODIFICATION OF THE NATURAL ENVIRONMENT Drainage in the past has altered some areas and cattle grazing affects the vegetation of the saltmarsh. Some wildfowling occurs by permit. Erosion of turf in the western part is occurring.

PRINCIPAL REFERENCE MATERIAL

Management plan and published and unpublished papers by Wildfowl Trust and Nature Conservancy Council.

Cairnsmore of Fleet National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED 23 October 1975 as National Nature Reserve under the National Parks and Access to the Countryside Act 1949 and further protected under the Wildlife and Countryside Act 1981; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION South-west Scotland, Wigtown district, Dumfries and Galloway region. 54°58'N, 4°17'W.

ALTITUDE 200-710m

AREA 1,922ha

LAND TENURE The site is partly owned by the Nature Conservancy Council, by purchase but part is privately owned and managed under a Nature Reserve Agreements.

PHYSICAL FEATURES Cairnsmore is an outlying Caledonian granite mass forming a distinctive ridge with high cliffs and screes along its eastern side. The lower ground is gently contoured moorland with a prevalence of peaty gleys and blanket peat of varying thickness.

VEGETATION This is now the only site in the district which includes unafforested ground. On the lower ground there are extensive areas of purple moor grass Molinia caerulea, often with local bog myrtle Myrica gale and Sphagnum spp. At higher altitudes heather Calluna vulgaris and Vaccinium heath are dominant, with local Trichophorum-Eriophorum blanket mire. The summits have Festuca ovina and Vaccinium and Rhacomitrium lanuginosum heath and Carex bigelowii.

FAUNA The animals are typical of the uplands, including mountain hare Lepus timidus, red deer Cervus elaphus and feral goats Capra sp. Breeding birds include golden eagle Aquila chrysaetos, raven Corvus corax, peregrine Falco peregrinus, red grouse Lagopus scoticus and some waders.

CULTURAL HERITAGE This area has suffered from the general clearance of woodland, as shown by tree stumps buried deep in the peat. The lower moor was formerly a grouse moor, and some drainage occured here.

ZONING/CONSERVATION MANAGEMENT A zone covering 85% of the reserve is managed by burning and grazing but the remainder, including the higher parts, is untouched by domestic stock. Present management is aimed at encouraging a more widespread growth of heather, and some areas are burnt. A flock of sheep is still grazed on the lower moor.

STAFF One warden, one shepherd

LOCAL ADMINISTRATION The Warden, Laurel Cottage, Bridge Street, Creetown, Dumfries and Galloway. The Regional Officer, The Nature Conservancy Council, Scotland (South West Region), The Castle, Loch Lomond Park, Balloch, Dunbartonshire G83 8LS, Scotland.

VISITOR FACILITIES There are no paths into the interior of the reserve. Access is restricted but information and leaflets can be obtained from the warden or NCC at Ballock.

SCIENTIFIC RESEARCH AND FACILITIES Research has concentrated on local flora and fauna and land-use history. It is proposed to use the reserve as a main area for a programme of research on upland land use: the effects of afforestation on wildlife, the relationships between certain upland species and their feeding and breeding requirements. The unafforested area of the reserve will be used as a control against which to measure changes in wildlife in the surrounding plantations of exotic conifers. There are no special facilities but a small laboratory is planned.

LOCAL POPULATION None in the reserve and the surrounding area is sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT Commercial conifer afforestation is occurring extensively in the surrounding areas. This is seriously affecting water quality and reducing the feeding habitat of birds of prey which need large, open areas.

PRINCIPAL REFERENCE MATERIAL
Unpublished reports and papers are held by the Nature Conservancy Council, Edinburgh.

Dyfi National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as a National Nature Reserve.

DATE ESTABLISHED 1641ha were established as a Nature Reserve in 1969, and the area was accepted as a Biosphere Reserve in June 1976, and a Ramsar site on 5 January 1976.

GEOGRAPHICAL LOCATION Coast of south central Wales, estuary of the Dyfi (Dovey) river, in the counties of Dyfed, Gwynedd and Powys. 52°32'N, 4°00'W.

ALTITUDE 0-15m

AREA Biopshere Reserve: 1,598ha; Nature Reserve: 2,095ha

LAND TENURE 1,570ha are leased and managed by the Nature Conservancy Council and 285ha in their full ownership.

PHYSICAL FEATURES The reserve is on the south side of the Dyfi (Dovey) estuary where a shingle spit has developed across part of the river mouth through northerly longshore drift. Behind the spit is an extensive salt marsh and the largest lowland raised peat bog in Britain, known as Cors Fochno (Borth Bog), part of which is in the reserve. At the northern end of the spit are Ynyslas Dunes. There is a temperate oceanic climate.

VEGETATION Many of the sand dunes are stabilised with marram grass Ammophila arenaria and other typical communities. The estuarine saltmarsh has been modified by the introduction and spread of cordgrass Spartina anglica, a British hybrid form, but considerable diversity remains. Cors Fochno is regarded as the best example in Britain of an actively growing raised bog with many Sphagnum species. Other communities include dwarf bog shrub with Salix, Betula and Calluna spp. and Phragmites communis reed beds.

FAUNA The polecat Mustela putorius, now rare, occurs in the dunes and bog. The wildfowl and wader populations of the estuary are large with over 3,000 duck in winter, including about 2,000 widgeon Anas penelope and 100 pintail A. acuta. The estuary is the most important station for wildfowl and migrant waders in Cardigan Bay. A small winter flock of Greenland white-fronted geese Anser albifrons flavirostris is the only one remaining in southern Britain, feeding on Cors Fochno and roosting in the estuary, the main winter quarters being in south-east Ireland. There is a diverse invertebrate fauna in the

littoral zone and Cors Fochno is of high entomological interest, containing outstanding habitat for various dragonflies, beetles and moths, including rosy marsh moth Coenophila subrosea, which was thought to be extinct in Britain until rediscovered at Dyfi in 1965.

CULTURAL HERITAGE The reserve area has been little used by man.

ZONING/CONSERVATION MANAGEMENT A public zone is restricted to Ynyslas dunes, the remainder of the reserve being of restricted access. The modified periferal belt of raised mire effectively buffers the central untouched area. There are nature trails through the dunes with broadwalks over unstable areas to try to minimize human erosion and stabilising areas are fenced. Access to all but the dunes is restricted by permit only. Shooting of wildfowl is controlled by permit.

STAFF One warden with four assistants in summer

LOCAL ADMINISTRATION Regional Officer (Dyfed & Powys), Nature Conservancy Council, Plas Gogerddan, Aberystwyth, Dyfed SY23 3EB.

VISITOR FACILITIES Accommodation is available in Borth nearby. There is an information centre at Ynyslas with a range of information leaflets, including guides to the nature trails, particularly with school parties in mind.

SCIENTIFIC RESEARCH AND FACILITIES The structure and biology of the area has been extensively studied, including the vegetation history over the past 7000 years from remains preserved in the peaks of the raised bog.

LOCAL POPULATIONS The reserve is backed by farmland and there is a medium-sized village just to the south at Borth with Aberystwyth about 12km away.

MODIFICATION OF THE NATURAL ENVIRONMENT Only about a third of the original bog survives due to peat-cutting, agricultural reclamation and drainage, and there is drainage around the margins of the present raised bog. Part of Cors Fochno now in the NNR was subjected to drainage in 1981, just before its purchase and remedial work of blocking ditches had to be undertaken. There are occasional outbreaks of fire on the mire. Human erosion is a problem on the dunes and foreshore which attract a large number of visitors.

PRINCIPAL REFERENCE MATERIAL The Nature Conservancy Council have produced a number of descriptive leaflets, information sheets and an educational handbook for parties visiting the dune area, available from Ynyslas Information Centre.

Isle of Rhum National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.31.12 (Scottish Highlands)

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED 1957 as a NNR; June 1976 as a Biosphere Reserve

GEOGRAPHICAL LOCATION One of the Inner Hebrides off north-west coast of Scotland. 57°N, 6°30'W.

ALTITUDE 0-812m

AREA Biosphere Reserve: 10,560ha; Nature Reserve 10,684ha

LAND TENURE Owned by the Nature Conservancy Council

PHYSICAL FEATURES This mountainous island is dominated by a cluster of spectacular peaks and ridges in the southern half formed of Tertiary ultrabasic volcanic rocks, including gabbros and peridotites. In the west is an area of acid granite with basalt outliers. The great variety of rock types, some unique to Rhum, have produced a wide range of soils. Three small rivers radiate from the uplands and their estuaries contrast with the predominantly rocky coastline of high cliffs, particularly on the west coast. The climate is highly oceanic, with an annual precipitation of 1500 to 3000mm.

VEGETATION The natural forest vegetation below the montane zone has been cleared and communities modified by burning and grazing. On exposed summits are subalpine-alpine pastures with mat grass Nardus stricta, stiff sedge Carex bigelowii and Rhacomitrum lanuginosum dominant. Some rare plants on the limited areas of lime-rich soils include alpine penny-cress Thlaspi alpestre and alpine saxifrage Saxifraga nivalis, and on volcanic soils are found Scottish asphodel Tofieldia pusilla, stone bramble Rubus saxatilis and mountain rock-cress Cardaminopsis petraea. Around the colonies of Manx shearwaters, on the slopes of Askival and Hallival, heavy manuring has produced lush grassland. The montane zone communities are mainly open Rhacomitrium heaths, Rhacomitrium-Festuca-Vaccinium grassland and Nardus heaths and grasslands. A few small relicts of Betula-Corylus-Sorbus woodland, once dominant, occupy less than 0.2ha. Dwarf shrub heath with ling Calluna vulgaris, purple moor grass Molinia caerulea, cross-leaved heath Erica tetralix and deer grass Trichophorum caespitosum is dominant over large areas. Blanket and raised bogs with cotton grass Eriophorum vaginatum, ling, Sphagnum spp., and, locally, deer grass, bog asphodel Narthecium ossifragum and Erica tetralix are common over all plateau and mildly sloping areas with poor drainage. Valley bogs, with purple moor grass or bog rush Schoenus nigricans dominant, are especially abundant on ultrabasic rocks on the western side of Rhum. A range of forest-derived grasslands includes: Agrostis-Festuca short grasslands; moor grass Molinia spp. grasslands, traditionally maintained by burning, present on damp flushed soils and occurring pure or with associated grasses such as Agrostis tenuis and Festuca vivipara; and rush Juncus acutiflorus marshes occurring on thin peat over gleyed soils and grading into the Molinia grasslands.

FAUNA There is a 1,500 strong herd of red deer Cervus elaphus scoticus. Two island races of small mammal are found, the Hebridean vole Microtus agrestis exsul and the Rhum mouse Apodemus hebridensis hamiltoni. The seabirds and raptors are of special interest in the bird fauna, and include mountain-top nesting colonies of Manx shearwaters Puffinus puffinus (over 130,000 pairs) and golden eagles Aquila chrysaetos. A number of white-tailed sea eagles Haliaeetus albicilla (45 up to 1982) have been brought from Norway to replace those persecuted to extinction early this century and are now breeding. Reafforestation with natural species has increased the abundance of many passerines. Corncrake Crex crex and peregrine Falco peregrinus also breed. The insects have been extensively studied and include vividly coloured Hebridean forms of several butterflies.

CULTURAL HERITAGE Crofting has been the major activity in the past and modified the vegetation. Kinloch Castle is still used to accommodate visitors, but all except one of the villages are deserted.

ZONING/CONSERVATION MANAGEMENT The Loch Scresort area has public access but other areas may only be visited by permit. The heathland is managed by burning. Over the last 15 years there has been a policy of establishing native trees and extensive reafforestation has occurred. A project to reintroduce breeding white-tailed sea eagles has been successful on a small scale. Tourist access is limited and nature trails have been established.

STAFF Total ten (chief warden, warden and eight estate staff).

LOCAL ADMINISTRATION The Regional Officer (West Scotland), The Nature Conservancy Council, Fraser Darling House, 9 Culduthel Road, Inverness.

VISITOR FACILITIES Hotel and hostel accommodation is available at Kinloch Castle and day trips may be made from Mallaig or Arisaig on the Scottish mainland. Nature trail and other information may be obtained from Rhum post office; Kinloch Castle or NCC offices in Inverness. Permits are needed from NCC to visit parts away from the Loch Scresort area.

SCIENTIFIC RESEARCH AND FACILITIES Surveys have been made of the flora, fauna and geology and routine monitoring continues. Major projects have included research on the red deer, Manx shearwater colonies, the establishment of native tree species and reintroduction of sea eagles. There are no special facilities.

LOCAL POPULATION One village remains and there are staff running hotel facilities at Kinloch castle.

MODIFICATION OF THE NATURAL ENVIRONMENT Derelict arable land on formerly enclosed fields and on hillside cultivation ridges, with their deserted village sites, has reverted to semi-natural grassland, heath and marsh. The vegetation is also influenced by centuries of grazing by domestic sheep, cattle, goats and ponies, and by regular burning and peat cutting. A single village remains with ornamental woodland, arable and pasture fields, farm buildings and cottages. However, little is being done to rehabilitate these areas to a more natural or useful condition.

PRINCIPAL REFERENCE MATERIAL

A selected bibliography is available, also a reserve handbook with background information on natural history, from NCC or Kinloch Castle.

Eggeling, W.J. (1964). A Nature Reserve Management Plan for the Island of Rhum, Inner Hebrides. J. App. Ecol. 1: 405-419.

Eggeling, W.J. (1965). Check List of the Plants of Rhum, Inner Hebrides. Part I and Part II. Trans. Proc. Bot. Soc. Edinburgh 40: 20-99.

Loch Druidibeg National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.31.12 (Scottish Highlands)

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED 1958 as National Nature Reserve under the National Parks and Access to the Countryside Act 1949, further protected under the Wildlife and Countryside Act 1981; June 1976 as a Biosphere Reserve and 5 January 1976 as part of a Ramsar site.

GEOGRAPHICAL LOCATION Isle of South Uist, Inverness-shire. 57°20'N, 7°15'W.

ALTITUDE 0-30m

AREA National Nature Reserve 1,677ha; Biosphere Reserve 1,658 ha

LAND TENURE 1,037ha owned by the Nature Conservancy Council; 634ha managed under a Nature Reserve Agreement with the owners.

PHYSICAL FEATURES The underlying rock is the remains of an ancient eroded platform of Lewisian gneiss. The eastern section of the reserve is a gently sloping basin of peat moorland, including Loch Druidibeg, which is shallow with many islands. The western part is 'machair', formed from shell sand, blown inland by the prevailing westerlies, making the peat more fertile. There are dunes along the coast and several small lochs which are eutrophic in the west grading to oligotrophic in the east. The climate is temperate moist oceanic.

VEGETATION The eastern section is least affected by man and has moorland vegetation with raised and low bog, dwarf shrub and deciduous bog shrub. The western section is predominantly machair, with freshwater marsh, reed swamp, dune grasslands and dune slack mires to permanent pasture inland. There are few trees but some scrub occurs on the islands in Loch Druidibeg and a small experimental plantation of the once native hardwoods of the Outer Islands has been established. The machair grasslands are rich in species, both cultivated and uncultivated, including the largest British fern, the royal fern Osmunda regalis is among them. Machair lochs contain species not commonly found in northern Scotland. The fucoid seaweeds (Phaeophycacea) are well represented in the marine plant associations.

FAUNA The reserve was established as a sanctuary for the biggest surviving population of greylag geese Anser anser in Britain. Mammals include short-tailed vole Microtus agrestis and otter Lutra lutra by Loch Druidibeg. The grey seal Halichoerus grypus is common offshore. Typical moorland birds occur in the east while duck and several species of waders breed and overwinter in the lochs and marshy areas of the west. The lochs and running waters contain salmon Salmo salar and both sea and brown trout Salmo trutta subspp.. The common eel Anguilla vulgaris occurs and two species of stickleback, three-spined Gasterosteus aculeatus and nine-spined Pungitius pungitius. Some of the freshwater aquatic species are uncommon or not found in mainland freshwaters. Over 900 species of invertebrate have been identified.

CULTURAL HERITAGE Centuries of crofting have produced a semi-natural landscape which is still maintained. Sheep and cattle are grazed and some areas cultivated with rye, oats and potatoes. The freshwaters are managed for a migratory salmon and trout fishery and wildfowling takes place on the western section.

ZONING/CONSERVATION MANAGEMENT There is an experimental plantation of nature hardwoods established by the Nature Conservancy Council. Access is restricted to the eastern area during the goose breeding season. The historic crofting, grazing regime is being maintained, to preserve its associated wildlife.

STAFF One warden, one honorary warden

LOCAL ADMINISTRATION The Regional Officer (North West Scotland), The Nature Conservancy Council, Fraser Darling House, 9 Culduthel Road, Inverness.

VISITOR FACILITIES There are small numbers of visitors, mostly ornithologists in spring or early summer, the greylag geese and possibility of seeing rare migrants being a major interest for visitors. Permits are required, available from NCC at Inverness, to visit the eastern area when the geese are breeding.

SCIENTIFIC RESEARCH AND FACILITIES Studies have been made of the population dynamics of the native greylag goose and physical and botanical studies of the machair. There are no special facilities.

LOCAL POPULATION Two crofting townships lie within the reserve, but the area is generally sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT This area is only semi-natural in parts, but these areas do preserve traditional crofting landscapes well. Predation of wild animals by crofters' cats and dogs is a problem.

PRINCIPAL REFERENCE MATERIAL

Reserve management plan and visitors' handbook.
Newton, L. (1969). Greylag geese (Anser anser) at Loch Druidibeg. Wildfowl 10: 156.

Moor House-Upper Teesdale Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as National Nature Reserves

DATE ESTABLISHED Moor House in 1952 and Upper Teesdale in 1963 as National Nature Reserves under the 1949 National Parks and Access to the Countryside Act: now protected by the 1981 Wildlife and Countryside Act. In June 1976 they were approved as a single Biosphere Reserve.

GEOGRAPHICAL LOCATION On the northern Pennine hills, Cumbria, northern England; Moor House NNR 54°65'N, 2°45'W, Upper Teesdale NNR 54°36'N, 3°12'W.

ALTITUDE 305-850m

AREA Total of 7,399ha; Moor House NNR 3,902ha, Upper Teesdale NNR 3,497ha

LAND TENURE Moor House NNR owned by the Nature Conservancy Council; Upper Teesdale NNR mostly managed by them under Nature Reserve Agreements with the owners with 25ha leased from the Northumbrian Water Authority.

A. Moor House National Nature Reserve

PHYSICAL FEATURES The reserve includes the western scarp of the Pennines and comprises moorlands on the highest Carboniferous limestone in Britain, and fells capped by sandstone. The reserve includes an almost complete section of Carboniferous strata with underlying Ordovician rocks exposed on the western escarpment. An impervious layer of glacial drift covers much of the limestone and has led to the formation of a layer of peat, two to eight metres deep, over much of the area. The climate is cool, sub-arctic, with a mean February temperature of -1°C rising to a mean in July of 11°C. Precipitation is 1850mm per annum.

VEGETATION This is modified by sheep grazing, burning and erosion. 60% of the reserve is covered by blanket bog, a quarter of which is either eroding or in the process of recolonisation. The dominant community on the blanket bog is heather Calluna vulgaris, cotton grass Eriophorum vaginatum and Sphagnum mosses. On the western escarpment heavy sheep grazing has removed the heather and there is less Sphagnum. Species diversity is poor on the bog and acidic and ill-drained grasslands, developed on peaty gleys and podsols, which have large areas dominated by moor rush Juncus squarrosus and mat grass Nardus stricta. At higher altitudes, flushes, especially those enriched by calcium, are rich in bryophytes, whilst limestone outcrops and old lead workings provide habitats of considerable interest and species rarity. Subalpine Festuca spp. grasslands cover the summmits.

FAUNA The most prominent mammal is the Swaledale sheep. Small mammals are common but few in species. The breeding bird population includes red grouse Lagopus scoticus, the area formerly being a grouse moor, a variety of wader species and a few passerines. Trout Salmo trutta are common in most streams. The reserve, however, is best known for its invertebrate fauna, many of which show affinity with northern Scandinavia (Coulson and Butterfield, 1985).

CULTURAL HERITAGE Past land use has modified the vegetation, particularly sheep grazing, lead mining and management as a grouse moor.

ZONING/CONSERVATION MANAGEMENT Sheep are still grazed and maintain a traditional land use but public access is limited to rights of way, except by permit. A warden and staff are based in the reserve. A management plan was in the stages of preparation in 1986.

LOCAL ADMINISTRATION The Warden, Moor House Field Station, Garrigell, Celston, Cumbria CA9 3HG. The Regional Officer (North West England), The Nature Conservancy Council, Blackwell, Bowness-on-Windermere, Cumbria.

VISITOR FACILITIES A long-distance path, the Pennine Way, crosses the reserve but access is limited to rights of way, except by permit. Accommodation is available in nearby villages, but the area is remote and little visited, mainly by walkers.

SCIENTIFIC RESEARCH AND FACILITIES The reserve was acquired as an experimental research area in the Tundra Biome studies of the International Biological Programme and was the main United Kingdom moorland site for productivity studies (1967-1972). Research is undertaken by staff from the Nature Conservancy Council and the Institute of Terrestrial Ecology's Merlewood Research Station, and from universities and other research institutions. Projects include a major integrated study of blanket bog productivity and ecosystem functioning. Conservation and land-use problems have also been investigated. Climatological records have been taken since 1952 and together with other regularly maintained data are available at the field station. Moor House field station has laboratory facilities and accommodation for 12 scientists.

MODIFICATION OF THE NATURAL ENVIRONMENT Grazing by sheep over the past 1,000 years has severely modified the vegetation except on inaccessible rock ledges, so that very few trees survive. The influence of lead mining, mainly in the 19th century, is clearly visible, with prospecting opencuts, mine tips, and old surface drains frequent. There is some local damage from over-use of the Pennine Way.

PRINCIPAL REFERENCE MATERIAL

Conway, V.M. (1955). The Moor House National Nature Reserve, Westmorland. Handbook, Society for the Promotion of Nature Reserves.

Coulson, J.C. and Butterfield, J.E.L. (1985). The invertebrate communities of peat and upland grasslands in the North of England and some conservation implications. Biol. Conserv. 34: 197-225.

Heal, O.W. (1971). A brief review of progress in the studies at Moor House (UK). In Wielgolaski, F.E. and Rosswall, T. (eds.) Proceedings, IV International Meeting on Biological Productivity of the Tundra, Leningrad, 1971: 295-304. Stockholm.

Heal, O.W., Jones, H.E. and Whittaker, J.B. (1975). Structure and functions of tundra ecosystems Moorhouse. U.K. Ecol. Bull. Stockholm 20: 295-320.

Heal, O.W. and Perkins, D.F. (1976). I.B.P. studies on montane grasslands and moorlands. Phil. Trans. Roy. Soc. London.

Heal, O.W. and Perkins, D.F. (1978). Production Ecology of British Moors and Montane Grasslands. Springer Verlag, Berlin. Pp. 3-16.

Johnson and Dunham (1963). A Monograph of the Geology of Moorhouse, HMSO, London.

Rawes, M. (1981). Further results of excluding sheep from high level grasslands in the North Pennines. J. Ecol. 1: 281-300.

Rawes, M. and Welch, D. (1969). Upland productivity of vegetation and sheep at Moorhouse National Nature Reserve. Oikos supplementum 11: 7-12.

Rawes, M. and Hobbs, R. (1979). Management of semi-natural blanket bog in the Northern Pennines. J. Ecol. 42: 187-210.

Welch, D. and Rawes, M. (1964). The early effects of excluding sheep from high level grasslands in the North Pennines. J. Appl. Ecol. 1: 281-300.

Welch, D. and Rawes, M. (1969). The vegetation of the Moor House National Nature Reserve in the Northern Pennines, England. Vegetation 16: 239-284.

A large body of published work includes over 250 published scientific papers; a bibliography is available from the Officer-in-Charge, Moor House Field Station, Nature Conservancy Council.

B. Upper Teesdale National Nature Reserve

PHYSICAL FEATURES The reserve includes a stretch of the River Tees and fells rising to 790m. Carboniferous rocks consisting of alternating layers of limestone, shale and sandstone underlie much of the reserve. Exposures of sugar limestone, botanically important, overlie the Whin Sill, an intrusion of dolerite which forms a prominent feature of the landscape.

VEGETATION The exposures of sugar limestone have an extraordinary number and abundance of rare or local montane plants. These occur for the most part in calcicolous communities which are set in a complex of heather moor, blanket mire and acidic grasslands, and there is transitional herb-rich Callunetum in close juxtaposition. At intervals on the slope rising to the highest fell summit there are areas of basic grassland on unaltered limestone. On the banks of the Tees are relicts of the field layer of former subalpine birchwood, fragments of which still remain close to the river. The whole area is of international importance for its unique combination of different phytogeographical elements, including arctic, alpine, arctic-alpine, continental, and northern montane.

FAUNA Ornithologically, the reserve is one of the richer moorlands in northern England, and breeding populations of waders are especially well represented. The fells are managed for red grouse Lagopus scoticus and sheep.

CULTURAL HERITAGE A long history of grazing and woodland clearance has altered the natural vegetation substantially.

ZONING/CONSERVATION MANAGEMENT Domestic stock are excluded from the woodland areas which are of relatively limited extent. Areas of dwarf shrub heath are burnt in rotation, as the fells are managed for red grouse and sheep.

STAFF One warden and one estate worker based at Middleton-in-Teesdale

LOCAL ADMINISTRATION The Regional Officer (North East England), Nature Conservancy Council, 33 Eskdale Terrace, Newcastle upon Tyne NE2 4DN, Tyne and Wear.

VISITOR FACILITIES None in the reserve

SCIENTIFIC RESEARCH AND FACILITIES Research projects by Nature Conservancy staff and university departments are in progress. The main aim is to investigate the relationships between plants and animal communities and the factors, including human activities, which influence them in order to determine how their exceptional interest and variety may be maintained. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT The woodland cover which developed during the Boreal period has been substantially cleared since the Iron Age to permit grazing of stock and only small wooded areas remain. Burning and grazing outside the woodland areas maintain a not completely natural vegetation.

PRINCIPAL REFERENCE MATERIAL

Clapham, A.R. (1978). Upper Teesdale: the area and its natural history. Collins, London.

Coulson, J.C. and Butterfield, J.E.L. (1985). The Invertebrate Communities of Peat and Upland Grasslands in the North of England and Some Conservation Implications. Biol. Conserv. 34: 197-225.

Pigott, C.D. (1956). The vegetation of Upper Teesdale in the North Pennines. J. Ecol. 44: 545-586.

Ratcliffe, D.A. (1978). Plant Communities. In: Upper Teesdale: the area and its natural history. Collins, London. Pp. 64-87.

North Norfolk Coast Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

DATE ESTABLISHED The Biosphere Reserve was approved in June 1976, amalgamating four already protected areas, and ratified as a Ramsar site on 5 January 1976.

GEOGRAPHICAL LOCATION The Biosphere Reserve comprises an almost continuous 40km stretch of the North Norfolk Coast. It is formed of four units, which will be described separately: Scolt Head National Nature Reserve, Holkham National Nature Reserve, Blakeney Point Site of Special Scientific Interest and Cley and Salthouse Site of Special Scientific Interest; 52°56' - 52°57'N, 0°43' - 1°00'E.

AREA Total area of Biosphere Reserve 5497ha

A. Scolt Head National Nature Reserve

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED It was set up in 1954 as a National Nature Reserve under the National Parks and Access to the Countryside Act 1949, now protected under the Wildlife and Countryside Act 1981.

GEOGRAPHICAL LOCATION On the north Norfolk coast, in Eastern England, from Brancaster to Burnham Overy Staithe, including Scolt Head Island; 52°57'N, 0°43'E

ALTITUDE 0-20m

AREA 728ha

LAND TENURE Owned by the National Trust and Norfolk Naturalists' Trust but leased to the Nature Conservancy Council under the National Parks and Access to the Countryside Act 1949 and now further protected under the Wildlife and Countryside Act 1981.

PHYSICAL FEATURES The reserve comprises 9km of coastline which is made up of intertidal sand and mudflats, shingle ridges, sand dunes and saltmarshes. Separated by narrow creeks from the mainland is Scolt Head Island, a 6km long shingle bank with several southerly recurves at its western end, which is capped with sand dunes up to 20m high. Extensive saltmarshes of varying ages have developed between the island and mainland.

VEGETATION Dune grassland covers 90ha. It is dominated by sand couch grass Agropyron junceiforme, marram grass Ammophila arenaria and sand sedge Carex arenaria, depending on elevation and sand stability. Saltmarsh occupies 270ha and is dominated by glasswort Salicornia spp., sea aster Aster tripolium, sea purslane Halimione portulacoides and common saltmarsh grass Puccinellia maritima. The intertidal flats, covering 330ha, are mainly unvegetated with seasonal growth of eel grass Zostera spp. and green algae Enteromorpha spp. and Vaucheria spp. Shrubby seablite Suaeda fruticosa, which grows mainly on shingle ridges, is at the northerly limit of its European distribution.

FAUNA This area is of major importance for waterbirds, owing to its variety of habitats and position. It is a major wildfowl reguge and large numbers of brent geese Branta bernicla winter. Numerous migratory waders call on autumn and winter passage and its exposed location makes it a common landfall for a variety of vagrants. At Scolt Head and Blakeney Point about a twelfth of the world population of sandwich tern Sterna sandvicensis breed, the largest colony in Britain with up to 4500 pairs. About 500 pairs of common tern S. hirundo and several species of wader also breed.

ZONING/CONSERVATION MANAGEMENT There is a restricted zone from May to July, the tern breeding season, at the western end of the island. A management plan will be drafted in 1987-1988. The general management policy is to allow natural evolution of the physiographic features and vegetative successions. Positive management includes sand dune maintenance and protecting breeding tern colonies from disturbance.

STAFF One warden

LOCAL ADMINISTRATION The Regional Officer (East Anglia), The Nature Conservancy Council, 60 Bracondale, Norwich NR1 2BE.

VISITOR FACILITIES Access to Scolt Island is by boat from Brancaster Staithe or Overy Staithe. Accommodation is available in several villages nearby.

SCIENTIFIC RESEARCH AND FACILITIES The area has been well researched, particularly the formation of the shingle ridges and salt marsh colonization. There is small laboratory on the mainland.

LOCAL POPULATION There are several small villages on higher ground just to the south of the reserve, but the area is predominantly agricultural, with no large towns.

MODIFICATION OF THE NATURAL ENVIRONMENT There is some erosion of the sand dunes by visitor trampling.

PRINCIPAL REFERENCE MATERIAL

Steers, J.A. (ed.) (1960). Scolt Head Island (2nd Ed.). Heffers, Cambridge.

Steers, J.A. (ed.) (1971). Blakeney Point and Scolt Head Island. National Trust.

B. Holkham National Nature Reserve

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED It was set up in 1967 as a National Nature Reserve under the National Parks and Wildlife Act 1949 and is now further protected under the Wildlife and Countryside Act 1981; accepted in June 1976 as part of the North Norfolk Coast Biosphere Reserve

GEOGRAPHICAL LOCATION In eastern England, on the north Norfolk coast from Overy marshes west of Wells to Blakeney; 52°56'N, 0°52'E

ALTITUDE 0-20m

AREA 3,880ha

LAND TENURE 1,700ha managed by the Nature Conservancy Council under a Nature Reserve Agreement with the owners, Holkham Estate; 2,225ha leased from the Crown Estate Commissioners by the NCC.

PHYSICAL FEATURES The reserve extends for 17km between Burnham Overy and Blakeney. West of Wells it consists mainly of sand dunes and reclaimed marshland now in agricultural use, while east of Wells, it includes one of the largest saltmarshes in England. Formerly the whole area was saltmarsh with fringing dunes but reclamation of the western section was completed in the mid-19th century. Intertidal sand and mudflats border the entire length of the reserve, and are over 2km wide in places.

VEGETATION Dune grasslands occupy 90ha and are dominated by sand couch grass Agropyron junceiforme, marram Ammophila arenaria and sand sedge Carex arenaria, depending on height above high tide. Some areas on the south of the dunes contain a moss and lichen community. 100ha of Corsican pine Pinus nigra var. maritima were planted from 1853-1890 and have spread naturally on the

seaward side. In 1953 inundation by the sea killed a strip of pines to landward of the dune system; this is now regenerating. Herb, shrub and broad-leaved tree species are becoming established as a result of shelter from the sea and the increase in humic material resulting from the pines; there are 10ha of developing deciduous woodland. Of 700ha of agricultural land reclaimed from saltmarsh, half is arable and half pasture. The reserve is the northern limit of the range of a number of species. Marine vegetation includes 2,400ha of intertidal flats with seasonal growth of eelgrass Zostera and green algae, including species of Enteromorpha and Vaucheria. The saltmarsh occupies 600 ha and succession is typified by Salicornia spp., Aster tripolium, Limonium vulgare, Halimione portulacoides particularly fringing creeks, Puccinellia maritima, Armeria maritima and Artemisia maritima.

FAUNA The wide range of habitats and their geographical position results in a diverse population of resident and migratory birds. More than 150 species have been recorded. Small numbers of pink-footed geese Anser brachyrhynchus and white-fronted geese A. albifrons frequent the area in winter and it constitutes a major waterfowl refuge, the mudflats and creeks having locally abundant concentrations of invertebrates of importance as wildfowl and wader foods. Natterjack toads Bufo calamita and common lizard Lacerta vivipara occur in the dunes.

ZONING/CONSERVATION MANAGEMENT The farmland is not accessible to the public. The general policy is to allow natural evolution of the physiographic features and vegetative succession. Positive management is concerned mainly with protection of the dunes, the western half receiving intense tourist pressure.

STAFF One warden

LOCAL ADMINISTRATION The Regional Officer (East Anglia), The Nature Conservancy Council, 60 Bracondale, Norwich NR1 2BE.

VISITOR FACILITIES Access is unrestricted to most areas, the beaches within and adjacent to the reserve being used by considerable numbers of visitors in the summer months. Camping and caravanning facilities exist nearby at Wells.

SCIENTIFIC RESEARCH AND FACILITIES The area is a classic site for the study of vegetational succession in saltmarsh and dunes. There are no special facilities.

LOCAL POPULATION The coastline is backed by farmland and there are many villages in the area, of which Wells, less than two kilometres from the reserve, is the largest.

MODIFICATION OF THE NATURAL ENVIRONMENT 700ha of agricultural land was reclaimed from saltmarsh from the 17th to the 19th century. Over much of this area the former creek patterns and flora have been destroyed by cultivation; drainage is now a by grid of mechanically maintained canals. Grass sea walls of various antiquity traverse the area. An attempt to reclaim another area of saltmarsh failed but the canalised creeks still remain. Planting of pines was originally undertaken to prevent wind-blown sand inundating newly reclaimed farmland, and they are now spreading naturally. Parts of the western half of the reserve are used intensively by tourists during July-September, and there is a road out to the coast from Wells, allowing easy access.

PRINCIPAL REFERENCE MATERIAL

Steers, J.A. (Ed.) (1971). Blakeney Point and Scolt Head Island. National Trust.

A descriptive leaflet is available from the NCC.

C. Blakeney Point Site of Special Scientific Interest

LEGAL PROTECTION Fully protected as a SSSI

DATE ESTABLISHED Declared a SSSI in 1954 under the National Parks and Access to the Countryside Act 1949 and now fully protected under the Wildlife and Countryside Act 1981 and the 1985 Amendment. It was approved as part of the North Norfolk Coast Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION On the north Norfolk coast, eastern England; 5°57'N,1°00'E

ALTITUDE 0-6m

AREA 574ha

LAND TENURE National Trust

PHYSICAL FEATURES Blakeney Point is a shingle and sand spit which leaves the mainland at Cley and extends 6km westwards to Blakeney. At the western end it has a series of southerly recurves with extensive ridges of sand dunes and saltmarsh to the south side, typical of the north Norfolk coast.

VEGETATION There are a variety of maritime habitats. Dune grassland covers 60ha, including some sand/shingle communities dominated by Agropyron junceiforme, Ammophila arenaria and Carex arenaria depending on sand stability and elevation above high tide. The main shingle ridge is discontinuously colonised on its southern, inland side by Suaeda fruticosa, Glaucium flavum, Silene maritima, Sedum acre, Rumex crispus and Lotus corniculatus. The intertidal sands and muds cover 260ha and are largely unvegetated but some have seasonal growths of Zostera spp. and green algae. Saltmarsh covers 180ha and the succession includes Salicornia spp., Aster tripolium, Limonium vulgare, Halimione portulacoides, Puccinellia maritima, Armeria maritima and Artemisia maritima.

FAUNA The reserve is important for waterbirds, including wintering waders and breeding birds. The largest colony in Western Europe of 150-200 pairs of little tern Sterna albifrons breed, as well as many common tern S. hirundo. Brent geese Branta bernicla winter in numbers.

ZONING/CONSERVATION MANAGEMENT Access to the ternery is restricted during the breeding season. The reserve is managed by the National Trust.

STAFF One warden

LOCAL ADMINISTRATION The National Trust, East Anglia Regional Agent, Blickling, Norwich NR11 6NF.

VISITOR FACILITIES Accomodation is available in villages along the coast and the beach has many visitors from July to September. Visits to the ternery during the breeding season must be accompanied by the warden. Access to the spit is by boat or by walking from the eastern end.

SCIENTIFIC RESEARCH AND FACILITIES The flora and physiology of the point have been researched extensively since 1920 and regular visits are made from the University of London. There are no special facilities.

LOCAL POPULATION The immediate area is farmland and there are many villages in the area, including Cley and Blakeney.

MODIFICATION OF THE NATURAL ENVIRONMENT There is some erosion of the dunes by holidaymakers. A few disused buildings remain, including a lifeboat house and several huts.

PRINCIPAL REFERENCE MATERIAL None listed

D. Cley and Salthouse Marshes Site of Special Scientific Interest

LEGAL PROTECTION Fully protected as a SSSI

DATE ESTABLISHED Declared a SSSI in 1966 uner the National Parks and Access to the Countryside Act 1949 and now more fully protected under the Wildlife and Countryside Act 1981 and the 1985 Amendment. It was approved as part of the North Norfolk Coast Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION On the north Norfolk coast, eastern England; 52°57'N, 1°00'E

ALTITUDE 0-20m

AREA 315ha

LAND TENURE The western half is owned by the Norfolk Naturalists' Trust, the eastern half by one principal, but several private, owners.

PHYSICAL FEATURES The area is bounded to the north by a 4km long shingle ridge and includes man-modified saltmarsh and pasture. Regular tidal inudation has been prevented by a sea wall built at the western end but sea water sometimes tops the shingle bank, creating a variety of aquatic habitats, from saltwater to fresh, while freshwater springs supply the southern part. The River Glaxen channel lies to the east.

VEGETATION The shingle bank is vegetated on its southerly, landward side by Silene maritima, Sedum acre, Glaucium flavum and agricultural weeds. Between the shingle and saltmarsh are Suaeda fruticosa, Artemisia maritima and Halimione portulacoides. In sandier areas, Corynephorus canescens and Frankenia laevis grow. Areas of saltmarsh typical of north Norfolk grow north of the New Cut Drain as salt water percolates through, and sometimes comes over, the shingle, including Aster tripolium, Limonium vulgare, Spartina anglica, Triglochin maritima and Puccinellia maritima. South of this drain, brackish conditions occur as there are freshwater springs and a drain on the southern boundary. Extensive reedbeds of Phragmites spp. occur, with Juncus gerardii, Ranunculus bandotii, Carex otrubae, Scirpus maritimus, Sparganium erectum and Typha latifolia. There are also some damp grazed areas which support Juncus articulatus, Potentilla anserina, Alopecurus geniculatus and Polypogon monspeliensis.

FAUNA The area is renowned for waterbirds, including thousands of migrants and many breeding birds. Brent geese Branta bernicla winter in the area and breeding birds include black-tailed godwit Limosa limosa, bittern Botaurus stellaris, avocet Recurvirostra avosetta and bearded tit Panurus biarmicus. Otters Lutra lutra can be seen in the area.

CULTURAL HERITAGE The reserve owes much of its present characteristics to man, as seawater incursion of what was formerly saltmarsh has been greatly reduced.

ZONING/CONSERVATION MANAGEMENT The area is managed as a variety of saltwater and freshwater habitats by maintenance of the sea wall and controlled flooding with freshwater. Cattle graze some parts, but the rest is managed as a nature reserve by the Norfolk Naturalists' Trust, primarily as a bird reserve. Reedbeds are managed for maximum growth, to provide cover and nest sites for many paserines.

STAFF One warden

LOCAL ADMINISTRATION The Conservation Officer, Norfolk Naturalists' Trust, 72 The Close, Norwich, Norfolk.

VISITOR FACILITIES There are a variety of visitor facilities in the surrounding area.

SCIENTIFIC RESEARCH AND FACILITIES Certain types of research are precluded but the reserve has potential for behavioural studies of birds. There are no special facilities.

LOCAL POPULATION The surrounding area is predominantly farmland with a few small villages.

MODIFICATION OF THE NATURAL ENVIRONMENT The area is semi-natural, the water regimes being managed, and grazing is allowed. Some wildfowling also occurs. The extent of some saltwater broads is being reduced by sand incursion during storms.

PRINCIPAL REFERENCE MATERIAL Annual reports appear in the Norfolk Bird and Mammal Report, published by the Norfolk Naturalists' Trust and Norfolk and Norwich Natural History Society.

Silver Flowe-Merrick Kells Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Site of Special Scientific Interest

DATE ESTABLISHED Silver Flowe was established on 16 June 1956 as a NNR under the National Parks and Access to the Countryside Act 1949 and further protected under the Wildlife and Countryside Act 1981. Merrick Fells SSSI was established under this 1949 Act and given further protection by the 1981 Act and its Amendment in 1985. Both areas were accepted as a single Biosphere Reseve in June 1976 and 608ha, including the Flowe, designated a Ramsar site on 24 July 1981.

GEOGRAPHICAL LOCATION South-west Scotland, Wigtown and Stewartry districts, Dumfries and Galloway region. 55°06'N, 4°30'W.

ALTITUDE 228-822m

AREA 3,088ha; Silver Flowe NNR comprises 191ha. The remainder of the area is included in Merrick Kells Site of Special Scientific Interest.

LAND TENURE All the land is owned by the Forestry Commission. The 191ha of the Silver Flowe reserve is leased to the Nature Conservancy Council.

PHYSICAL FEATURES The Merrick Kells are a series of ridges of metamorphic rocks, part of a glaciated plateau with extensive corries and well-developed periglacial features. The broad glaciated valley containing the Silver Flowe is floored with a series of patterned blanket mires exhibiting a complete gradation from discrete valley mire to blanket mire. This series of patterned blanket mires constitutes the least disturbed and most varied extent of acid peat land in southern Scotland as well as one of the best developments of aligned hummock-hollow systems in Britain.

VEGETATION The patterned mire is dominated by species of Trichophorum and Eriophorum with an abundance of moss Sphagnum plumulosum, great sundew Drosera anglica, Pleurozia purpurea and Campylopus atrorirens. On the eastern granite slopes of the Kells is a submontane vegetation which includes Molinia caerulea and Calluna vulgaris. The summit plateau of Merrick has a grassier cover with Nardus stricta and Juncus squarrosus. A few notable montane species occur on the north-facing cliffs.

FAUNA The area supports herds of red deer Cervus elaphus and feral goats Capra hircus together with a few pairs of peregrine falcon Falco peregrinus and raven Corvus corax. The dragonfly Aeschna caerulea breeds in the pools of the mire system.

CULTURAL HERITAGE The site has has a long history of grazing and burning and some gravel was extracted from rivers in the past.

ZONING/CONSERVATION MANAGEMENT The NNR encloses 6% of the biosphere reserve and both this and Merrick Kells SSSI are contained within Galloway Forest Park (66,000ha). Public access to Silver Flowe is restricted. The site is now more or less undisturbed.

STAFF One warden; forestry commission staff manage the SSSI part.

LOCAL ADMINISTRATION The Warden, Laurel Cottage, Bride Street, Creetown. The Regional Officer, Nature Conservancy Council, Scotland (South-west Region), The Castle, Loch Lomond Park, Balloch, Dunbartonshire.

VISITOR FACILITIES There are none connected with the reserve, and access to the Flowe is by permission from the Warden. The surrounding Galloway Forest Park has much interest, particularly to walkers.

SCIENTIFIC RESEARCH AND FACILITIES Much research has been and is being carried out on the stratigraphy, hydrology and phytosociology of the mire systems. In addition, there has been research on the contact metamorphism of the granite aureole. There are no special facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT The commercial afforestation which has occurred extensively in the surrounding areas is seriously affecting water quality and reducing the feeding habitat of birds of prey, which need large, open areas. The land uses which produced the present features are now discontinued so the reserve may not be in stable equilibrium with present management practices.

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St Kilda National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.31.12 (Scottish Highlands)

LEGAL PROTECTION Owned by the National Trust for Scotland and declared inalienable by the Council of the Trust. The whole archipelago is designated as a National Scenic Area by the Secretary of State for Scotland. It is also subject to additional planning control by means of byelaws enacted for the safeguarding of natural and cultural interests. The property is leased to the Nature Conservancy Council who in 1957 under Section 16 of the National Parks and Countryside Act declared it a National Nature Reserve. It is also notified as a site of Special Scientific Interest under Section 28 of the Wildlife and Countryside Act 1981. A substantial part of the main island of Hirta is scheduled as an Ancient Monument.

DATE ESTABLISHED Declared a National Nature Reserve on 4 April 1957 and a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION Lies on the Atlantic continental shelf, 64km west of North Uist, Outer Hebrides and 160km from mainland Invernesshire. 57°49'N, 8°34'W.

ALTITUDE 0-430m

AREA The archipelago comprises the four islands of Hirta, Dun, Soay and Boreray plus the sea stacks of Stac an Armin, Stac Lee and Levenish. Total area 853ha. The Biosphere Reserve area covers 842ha.

LAND TENURE The islands were bequeathed to the National Trust for Scotland by the 5th Marquess of Bute in 1957 and leased to the Nature Conservancy Council who declared the islands a National Nature Reserve on 4 April 1957. The NCC subleased a 3ha part of Hirta to the Ministry of Defence in 1957 for the construction of a small radar station for surveillance of a nearby missile range. This is still in operation but is controlled by very strict lease agreements.

PHYSICAL FEATURES This group of islands is the remains of a Tertiary ring volcano, weathered and glaciated to produce dramatic precipitatious cliffs, the highest sea cliffs in Europe. The cliffs of Boreray and Soay rise sheer to over 370m and the north face of Conachair hill on Hirta is 430m high. Two stacks adjoining Boreray are the highest in the British Isles: Stac an Armin 191m and Stac Lee 165m. The rocks are predominantly gabbro, granophyre, dolerite and basalt. The climate is extremely oceanic, of a cool Atlantic type with extremely high humidity and strong winds.

VEGETATION The vegetation is representive of an extreme oceanic island group with a northern climate of the cool Atlantic type, modified by its prevailing high humidity (generally peaty nature of soils, and wide distribution of oceanic plants such as liverwort Frullaria germana), by the effect of salt spray even hundreds of metres inland resulting in Plantago dominated swards on the cliff tops, and the fertilizing effects of vast numbers of nesting seabirds which gives rise to rich turfs. Salt tolerant plants such as Asplenium marinum and Grimmia maritima occur even inland, but much of the grassland has a sub-maritime character (such as Soay and Boreray) consisting of Holcus lanatus, Agrostis stolonifera, A. tenius, Anthoxanthum odoratum and Festuca rubia. The less maritime communities occuring on Hirta are mainly a range of acidic species - poor grassland and heaths of a submontane character consisting of a mixed Nardus-Calluna - Rhacomitrium lanuginosum heath covering extensive areas with Luzula sylvatica dominated grassland on Conachair summit. Northern Atlantic species include Botiychium lunaria, Ophioglossum vulgatum, Gentianella campestris, Ligusticum scoticum and Sedum rosea with Silene acaulis and Saxifraga oppositifolia representing the artic-alpine montane element. The Mediterranean-Atlantic liverwort Fossombonia angulosa also occurs here at its northernmost locality. The full range of habitats includes dwarf shrub heath, dwarf shrub moss tundra, low bog, meadow and freshwater marsh and over 130 species of flowering plants have now been recorded from the island group. There are no trees present, but pollen analysis indicates that the islands possessed a partial cover of birch hazel scrub during the period 5200-6400BP. Subsequent climatic deterioration led to the extinction of tree cover and the expansion of halophytic communities. However, Salix herbacea is still present. Subsequent to the evacuation of Village Bay there has been an increase in heather moorland. There is little intertidal vegetation due to the extreme exposure of the island group. The sub-littoral however supports dense kelp particularly Laminaria spp..

FAUNA St Kilda is an outstanding example of remote island ecological colonization and isolation of small populations causing genetic divergence in the endemic subspecies of St Kilda wood mouse Apodemus sylvaticus hirtensis and St Kilda wren Troglodytes troglodytes hirtensis. The massive sea-bird breeding populations form one of the largest concentrations in the North Atlantic. This comprises the world's largest colony of gannets Sula bassana (52,000 pairs in 1969, some 25% of the North Atlantic population), the largest and oldest British colony of fulmar Fulmaris glacialis (30,000 pairs) and about half of the British population of puffins Fratercula arctica. This species was formerly estimated at two to three million pairs but numbers have dropped substantially and have stabilized at the 300,000 pairs estimated in 1978. The islands are also one of the very few European breeding stations of the Leach's petrel Oceanodroma leucorhoa. Numbers of grey seals Halichoerus grypus are present around the islands. Finally the feral Soay sheep Ovis aries represent an ancient breed which has maintained its distinctions through isolation.

CULTURAL HERITAGE The islands have a great wealth of archaeological remains (defined as Ancient Monuments and protected by Statute) including evidence of Bronze Age occupation and Viking visits. The islands are believed to have been more or less continously occupied for approximately 2000 years with human habitation concentrated at Village Bay and Gleann Mor, although the few hectares previously cultivated have now reverted to grassland. For the last 800 years the islands were owned by Scottish clans (principally the Macleods of Macleod) and two successive settlements were constructed in 1836 and 1865. The inhabitants harvested seabird colonies and grazed up to 2000 sheep. After a series of outside influences, including religious missionaries, a devastating outbreak of smallpox, and tourism, the islands were evacuated in 1930.

ZONING/CONSERVATION MANAGEMENT The NCC under section 16 of the National Parks and Countryside Act has direct responsibility for the management of the islands, financed by the United Kingdom government. As a National Scenic Area it is covered by additional development controls and any proposed development must seek the advice of the Countryside Commission for Scotland and the NCC and if not resolved the matter is referred to the Secretary of State for Scotland. The whole site is managed as a National Nature Reserve. A Nature Reserve Management Plan, prepared by the NCC is now under revision. The wildlife has been protected and undisturbed since 1930 and in general active intervention is not required to conserve the site's values. Only in recent times have reasonably accurate estimates of bird population numbers of the different species been attempted. The reason for the decline in puffin numbers since the time they were cropped is not known. There is no planned management of the sheep population, or of past cultivations. The vegetation of Hirta, Soay and Boreray is grazed but Dun is not. The few hectares previously cultivated in Village Bay have now reverted to grassland. The activities of the Ministry of Defence installation are strictly controlled. The National Trust for Scotland organizes volunteer work parties who carry out restoration work on the village ruins. Starting in 1958, some five cottages, the church, school house, many cleits and walls have been rebuilt and the drains cleared. The restoration work is carried out in consultation with the Historic Buildings and Monuments, Directorate Scottish Development Department. Such work parties are planned to continue for the foreseeable future.

STAFF A seasonal warden is jointly employed by the NCC and the NT for Scotland and is present during April to mid-September.

LOCAL ADMINISTRATION Warden and reserve administration, Regional Officer NCC for NW Scotland, Fraser Darling House, 9 Culduthel Road, Inverness.
National Trust for Scotland, 5 Charlotte Square, Edinburgh EH2 4DU.

VISITOR FACILITIES Seasonal volunteer working parties are organized by the NT for Scotland, and are housed in the restored cottages. Access by visitors is restricted by lack of communication and landings (between May-June) are controlled by the warden. Several independent charter companies also run shorter trips but visitors remain onboard at night.

SCIENTIFIC RESEARCH AND FACILITIES Considerable survey work, mainly on Hirta has taken place over the last 100 years. The NCC carry out monitoring of the flora and fauna particularly in relation to the sea bird populations and to the Soay sheep, on which detailed studies of biology and population dynamics have been taking place over the last 25 years. The large number of scientific publications attest to the value of the islands as an outdoor laboratory, and there is very high level of cooperation between the NT for Scotland and the MOD with the NCC. The MOD have assisted in many ways in the scientific programme and in servicing the conservation and scientific teams in regard to transport, laboratory facilities, accommodation and catering. At present little archaeological excavations have been undertaken but the whole village is considered to be an extensive outdoor museum. The restored cottages are used to provide dormitories, common room, kitchens and museum space.

LOCAL POPULATION In the eighteenth century the population of the main archipelago was a little under 200 and although evacuated in 1930 the islands remain the remotest inhabited island group in the British Isles. The island is inhabited by the personnel of the Ministry of Defence's surveillance station and the reserve is protected by a seasonal warden employed jointly by the NCC and the NT for Scotland.

MODIFICATION OF THE NATURAL ENVIRONMENT All islands except Dun are grazed by feral sheep: the 3ha occupied by the MOD has a local effect as have small peat cuttings, and areas of derelict turf cutting and derelict cultivation. Some areas still used are rehabilitating to a more natural state.

PRINCIPAL REFERENCE MATERIAL

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Claish Moss National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.31.12 (Scottish Highlands)

LEGAL PROTECTION Totally protected as a National Nature Reserve

DATE ESTABLISHED Accepted as a Biosphere Reserve in January 1977, and as a Ramsar site in July 1981.

GEOGRAPHICAL LOCATION Located in Lochaber, in western Scotland; 56°00'N, 05°45'W.

ALTITUDE 0-20m

AREA Biosphere Reserve: 480ha; Nature Reserve: 563ha

LAND TENURE Owned by the Nature Conservancy Council

PHYSICAL FEATURES The area is an extensive raised domed mire, patterned by a linear series of ridges, pools and streams. The large amplitude and total scale of the pattern is unparallelled in Britain; these mires are more closely allied to Scandinavian patterned mires than anything else in Britain. The reserve adjoins an open water body of national importance, Loch Sheil.

VEGETATION The vegetation has typical Trichophorum-Eriophorum spp., with well-developed Rhacomitrium hummock facies. Many species characteristic of western blanket mire are present, including Molinia caerulea, Pleurozia purpurea, Campylopus atrovirens, Eleocharis multicaulis, Carex limosa, great sundew Drosera anglica and bog myrtle Myrica gale. Brown beak-sedge, Rhynchospora fusca, a plant of very restricted occurrence in Great Britain, is abundant in pools on some of the mire.

FAUNA The fauna includes red deer Cervus elaphus, otter Lutra lutra, red grouse Lagopus scoticus and greenshank Tringa nebularia.

ZONING/CONSERVATION MANAGEMENT None. Sheep grazing is now prevented

STAFF None

LOCAL ADMINISTRATION The Regional Officer (North West Scotland), Nature Conservancy Council, Caledonia House, 63 Academy Street, Inverness.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Stratigraphical and pollen analysis studies have been carried out to trace the vegetation history since postglacial times. There are no special facilities.

LOCAL POPULATION The surrounding area is sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT Although until recently open to grazing sheep, the area has suffered little deterioration except by occasional uncontrolled fires, which have led to some vegetation modification. It is small in size, and may need a buffer zone in the future.

PRINCIPAL REFERENCE MATERIAL No information

Taynish National Nature Reserve

BIOGEOGRAPHICAL PROVINCE 2.08.05 (British Islands)

LEGAL PROTECTION Fully protected as a National Nature Reserve

DATE ESTABLISHED 10 June 1977 as a National Nature Reserve under the National Parks and Access to the Countryside Act 1949, further protected by the Wildlife and Countryside Act 1981; January 1977 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION South-western Scotland, located on the coast of Argyll, Strathyclyde region, 56°00'N, 5°38'W

ALTITUDE 0-100m

AREA 326ha

LAND TENURE Partly owned by the Nature Conservancy Council

PHYSICAL FEATURES This is an area adjacent to Loch Sween of low ridges of schist rocks with poorly drained ground between. There is little tidal variation in the sheltered waters around the Taynish peninsula. The climate is cool temperate oceanic, with heavy rainfall, particularly in autumn.

VEGETATION The reserve contains the larges and least-disturbed fragment of native deciduous oak woodland remaining in Scotland. The woodland also contains ash Fraxinus excelsior, hazel Corylus avellana and rowan Sorbus aucuparia. There is a luxuriant growth of mosses, lichens and liverworts on the tree trunks as well as the forest floor because of low levels of atmospheric pollution and the maritime location. Some of the oceanic lichens are found nowhere else in Europe. There are also areas of open grassland and bog communities.

FAUNA The reserve has an important insect population, including marsh fritillary Euphydryas aurinia which is generally declining in Britain and Scotch argus Erebia aethiops.

CULTURAL HERITAGE The native woodlands in this area have been exploited for centuries for fuel, tools, timber and charcoal smelting by coppicing for a sustained yield, but this form of management has probably ensured their survival.

ZONING/CONSERVATION MANAGEMENT There are two main land use zones, the woodland where no grazing is allowed and open grassland where it is contained. Controlled grazing of cattle and sheep is carried out on the grassland areas to maintain their present composition. Public access is limited.

STAFF One honorary warden, but no permanent staff

LOCAL ADMINISTRATION The Warden, Arbory, Kilmichael-Glassary, by Lochgilphead, Strathclyde. The Regional Officer, The Nature Conservancy Council, Scotland (South West Region), The Castle, Loch Lomond Park, Ballock, Dunbartonshire G83 9LX, Scotland.

VISITOR FACILITIES There are no special facilities and permission to visit areas away from the road is required from the warden. An information leaflet is available from the NCC at Balloch.

SCIENTIFIC RESEARCH AND FACILITIES There have been limited surveys of fauna and flora. Monitoring of changes in plant and animal populations in response to reserve management is proposed. There are no special facilities.

LOCAL POPULATION None in the reserve and the surrounding area is sparsely populated.

MODIFICATION OF THE NATURAL ENVIRONMENT There is still some grazing of the grasslands, although this helps maintain habitat diversity. Wood and peat cutting in the past have altered the natural woodland but ceased in the nineteenth century. Now there is substantial afforestation with conifers in the surrounding areas which may leave the reserve very isolated, which is doubly unfortunate because of the reserve's small size. No permanent staff are assigned to the reserve.

PRINCIPAL REFERENCE MATERIAL

Nature Conservancy Council (1974). International Report on the Ecology of Taynish Wood. (Out of print)

Aleutian Islands National Wildlife Refuge

BIOGEOGRAPHICAL PROVINCE 1.12.09 (Aleutian Islands)

LEGAL PROTECTION The refuge is protected by the regulations governing the National Wildlife Refuge System under Title 50 of the United States Code of Federal Regulations. Portions of some refuge lands and have overlapping jurisdiction between the US Fish and Wildlife Service and Department of Defence. The original Executive Order states that the area be 'reserved and set apart as a preserve and breeding ground for native birds for the propagation of reindeer and fur-bearing animals and for the encouragement and development of the fisheries'.

DATE ESTABLISHED Established by Executive Order 1733 signed by President William H. Taft on 3 March 1913. Approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION The refuge comprises the Aleutian Islands excluding Sanak, Akun, Akutan, Tigalda, Umnak, Unalaska, Sedanka and all but 81ha of Amaknak. These islands extend in an arc from the Alaska Peninsula west for some 1,750km. 54°51'N, 163°22'W (eastern end of the chain); 52°55'N, 172°24'W (western end).

ALTITUDE 0-3041m

AREA 1,100,943ha

LAND TENURE The entire refuge is under control of the United States Government. However some lands are subject to selection by the Aleut village corporate under provisions of the Alaska Native Claims Settlement Act of 1971.

PHYSICAL FEATURES Most of the islands are mountainous being the emergent peaks of a submarine mountain range. Many have active volcanoes including Shishaldin on Unimak Island at over 3,000m. The larger islands have numerous lakes and streams. Irregular shorelines with boulder or sand beaches, rocky cliffs and offshore islets and reefs. Climate is characterized by fog and clouds with sunshine almost a rarity. Rainfall is high in summer. The Aleutian Islands are noted for frequent and violent wind squalls. Summer temperatures do not exceed 20°C and winter temperatures are near freezing but sometimes drop below -12°C. Snow is prevalent in winter, although usually wet and slushy except at higher elevations.

VEGETATION The Aleutian Islands belong to the same floral and vegetational province as the Kamchatka Peninsula of Siberia (Hultén 1960 and 1968). This relationship is most prominent in the Near Islands, while the eastern islands show floristically closer relationships to the North American continent and more specifically to the Alaska Peninsula. The flora of the central Aleutians is generally of lower growth than that on the western or eastern island groups. Vegetation is composed of arctic-alpine species, dominated by the heath, grass and composite families. The Chain is essentially treeless except for a few spruce trees introduced by the early Russians or by the Americans during World War II. Vegetation occurs mainly from sea level to about 300m. Shacklette (1966) notes that below the 300m, the land is blanketed with a thick mat of vegetation comprising over 500 species of vascular plants, bryophytes and lichens. Above 300m, the wind plane as described by Hultén (1960) severely suppresses plant life and plant communities resemble those of alpine locations at lower latitudes. The vegetation of the Aleutians is classed as a terrestrial-maritime tundra ecosystem (Shacklette, 1966). Amundsen (1972) states of Amchitka that the '...isolation of the island,

maritime conditions and the low energy climate have predominated in the development of a rather uniform vegetation of relatively few important species'. This is probably true of the remainder of the Aleutian Islands except for Unimak Island, where alder dominates much of the surface. Amundsen (1972) identifies three general plant communities whose classification is primarily dependent on exposure and soil moisture drainage. The beach area: the beach community is dominated by beach rye Elymus arenarius mollis with reedgrass Calamagrostis nutkaensis, fescues and bluegrasses. Intermingled and below the grass zone are the decumbent succulent herbs: beach pea Lathyrus maritimus, sea bluebell Mertensia maritima, Honkenya peploides and Senecio pseudo-arnica. The bluff areas are almost entirely beach rye with scattered cow parsnip Heracleum lanatum, angelica Angelica lucida, cinquefoil Potentilla villosa, geum Geum macrophyllum and some sedge Carex spp.. The lowland tundra: lowland marshes contain mainly sedges with secondary species of reed-grass, bog blueberry Vaccinium uliginosum, marsh marigold Caltha palustris, yellow monkey flower Mimulus guttatus, horsetail Equisetum arvense and rushes Juncus spp.. Drier lowland sites are blanketed by crowberry Empetrum nigrum, reedgrass, mosses Sphagnum spp., caribou lichen Cladonia spp., sedges, cranberry Oxycoccus spp. and prostrate willow Salix spp.. Burreed Sparganium hyperboreum and rushes dominate most freshwater lakes. Other common species are, mare's tail Hippuris vulgaris, buttercup Ranunculus spp., water milfoil Myrophyllum spicatum and pondweed Potamogeton spp.. The upland tundra: upland areas are dominated by crowberry, willow, lichens, mosses and sedges. With increasing elevation the predominant lichen carpet thins and is increasingly interspersed with patches of bare rock and gravel. In the mountainous areas of the Near Islands several Asiatic species occur at their eastern limit such as false hellebore Veratrum album oxycepalum, goatsbeard Aruncus sylvestre, Cacalia auriculata, groundsel Senecio palmatus, thistle Cirsium kamtschaticum and Siberian mountain ash Sorbus sambucifolia. Species on the eastern Aleutians whose western limit is Unalaska Island include elderberry Sambucus racemosa, salmonberry Rubus spectabilis and alder Alnus crispa.

FAUNA Rich fauna particularly birds. Fauna on the easternmost islands is typical of the Alaskan mainland and on the western islands has Asiatic features. Olaus Murie described the Aleutians as a 'melting pot for faunal elements from two continents not yet reaching an equilibrium'. The main home of the sea otter is in the waters off islands in the central part of the chain from Adak to Kiska. It was once almost extinct through overhunting but strict protection has increased the population to nearly 60,000. The northern sea lion Eumetopias jubata are common. Unimak Island is an ecological extension of the Alaska Peninsula and is a stronghold of the brown bear Ursus arctos. The island also contains caribou Rangifer tarandus (over 1,000), wolf Canis lupus and wolverine Gulo gulo. Atka contains wild reindeer (over 2,000) and caribou have been introduced to Adak. Small mammals (excluding the tundra vole) such as vole, shrew, lemming, ground squirrel and weasel Mustela spp. are usually not found west of Unimak. Fomerly, the blue phase of the arctic fox Alopex lagopus was only found on Altu, and the red fox from Umak east. During the period from 1915-1925, blue foxes were introduced on the most of the Aleutians. Most noteworthy are the numerous colonial seabirds including fulmar Fulmanus glaicalis, two species of petrel, three species of cormorant Phalacrocorax spp., red-legged kittiwake Rissa brevirostris, glaucous-winged gull Larus glaucescens, guillemot, murre, murrelet, six species of auklet, two species of puffin, common loon Gavia immer, arctic loon G. arctica and red-throated loon G. stellata. Nesting in large numbers are black oystercatcher Haematopus bachmani, rock sandpiper Calidris ptilocnemis and northern phalarope Lobipes lobatus. Summer nesting birds include common teal Anas crecca (a Eurasian species), mallard A. platyrhynchos, pintail A. acuta,

greater scaup Aythya marila, merganser Mergus merganser and common eider Somateria mollissima. Wintering waterfowl include king eider S. spectablis, harlequin duck Histrionicus histrionicus and 50% of the world population of emperor goose Philacte canagica. The Aleutian Canada goose Branta canadensis leucopareia once occured on all the islands from Amlia westwards but now occurs only on tiny Buldir Island where no fox were introduced. It is now one of the world's rarest birds and habitat restoration is in progress to restock its former breeding range. Other species include bald eagle Haliaeetus leucocephalus (resident in substantial numbers), peregrine falcon Falco peregrinus, rock ptarmigan Lagopus mutus, willow ptarmigan L. lagopus (on Unimak) and some gyrfalcon Falco rusticolus. Abundant land birds are winter wren Troglodytes troglodytes, gray-crowned rosy finch Leucosticte arctoa, savannah sparrow Passerculus sandwichensis, fox sparrow Passerella iliaca, song sparrow Melospiza melodia, Lapland longspur Calcarius lapponicus and snow bunting Plectrophenax miralis. Asiatic birds include whooper swan Cygnus cygnus, falcated teal Anas falcata, Steller's sea eagle Haliaeetus pelagicus, wood sandpiper Tringa glareola, black-tailed godwit Limosa limosa, slaty-backed gull Larus schistisagus, black-headed gull L. ridibundus, oriental cuckoo Cuculus satwatus, eyebrowed thrush Turdus obscurus, arctic warbler Phylloscopus borealis, Siberian rubythroat Erithocus calliope, pied wagtail Montacilla alba, grey wagtail M. cinerea, yellow wagtail M. flava, brambling Fringilla montifringilla and rustic bunting Emberica rustica. The island streams are used by large numbers of spawning salmon.

ZONING/CONSERVATION MANAGEMENT None at present There is a major blue fox eradication effort planned for Kiska Island. Introduced blue phase Arctic foxes are numerous on the island, particularly in and adjacent to the Sinus Point auklet colony, one of the largest assemblages of birds in North America.

STAFF Current permanent staff of manager, two assistant managers, one administrative clerk, one maintenance (Amchitka) and one operator/engineer (R/V Aleutian Tern). Temporary staff are one clerk-typist, one labourer, one cook/deckhand (R/V Aleutian Tern), one goose keeper (Amchitka) and nine biological technicians.

LOCAL ADMINISTRATION Aleutian Islands National Wildlife Refuge, PO Box 5251, FPO Seattle, Washington 98791, or Aleutian Islands National Wildlife Refuge, PO Box 5251, Adale, Alaska 99695, USA.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research has been carried out for many years. Amchitka Island is the area with most base data (including 15 June 1971 issue of Bio Science devoted to the island). Potential research is unlimited. The nature of the Aleutians makes logistic support of research projects very difficult. The refuge has a support vessel (R/V Aleutian Tern: 65-foot) used for biological activities in the western Aleutians but this is greatly hampered by weather and sea conditions. These conditions plus the lack of landing strips precludes effective aerial logistic support. Another vessel is needed.

MODIFICATION OF THE NATURAL ENVIRONMENT Some islands have large areas of abandoned military installations from World War II such as quonset huts, roads, launching strips, warehouses, telephone lines and piles of trash of every description. There are active military and coast guard installations on Adak, Shemya and Attu. Amchitka Island was the site of extensive study and testing of underground nuclear devices. A blue fox commercial fur farming enterprise developed in the early 20th century utilizing wildlife for food.

Their pelts now have no value and complete removal of the introduced foxes is essential to restore native bird life. This has been carried out on Amchitka with a prompt and striking increase in wildlife on the island.

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Big Bend National Park

BIOGEOGRAPHICAL PROVINCE 1.09.07 (Chihuahuan)

LEGAL PROTECTION Totally protected, but there is one exception to resource removal. Fishing is allowed along the length of the Rio Grande.

DATE ESTABLISHED Approved in 12 June 1944 as a National Park; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Big Bend National Park is located in the southern portion of the Trans-Pecos area of Texas, entirely within Brewster County. It is bounded by 171km of Rio Grande, and also the international border with Mexico; 29°30'N, 102°-103°E.

ALTITUDE 533-2,388m

AREA National Park: 286,572ha; Biosphere Reserve: 283,247ha

LAND TENURE Federal government ownership

PHYSICAL FEATURES Vast expanses of fairly open Chihuahuan Desert are enclosed on the west, south and east by the Rio Grande, which passes through three major canyons. The river also forms the boundary between the United States and Mexico. In the middle of the desert are the Chisos Mountains, with elevations of 1000m or more above the desert floor, reaching a maximum elevation of 2388m. Ancient volcanic rocks and massive ocean-deposited limestone beds are present. Soil textures range from silt deposits along the river floodplain, to gravelly desert soils, to a gravelly but humus-enriched soil on the high mountains. Summer temperatures in the desert lowlands are extremely high but quite low in the mountains. Winter climate is pleasant in the desert, but temperatures of -18°C or less can occur in the mountains. Rainfall is light throughout the area; the high mountains average 350-380mm per year and the desert 200-300mm per year. Snow is uncommon, but does fall in the mountains occasionally.

VEGETATION There are four major vegetation zones within Big Bend, distributed along elevational gradients: 1. Woodlands - approximately 2% of the park area. The pinyon pine Pinus cembroides, oak Quercus spp. and juniper Juniperus spp. are primary species. A small unique vegetation zone of the woodlands is the ponderosa pine Pinus ponderosa - Douglas fir Pseudotsuga menziesii community comprising only 240 ha and located in the highest elevations of the high country. Also found is Arizona cypress Cupressus arizonica, this being its easternmost occurrence. 2. Grasslands - 48% of the park area, between woodland and shrub desert. Dominant plants are yuccas Yucca spp., sotol Dasylirion leiophyllum and various grasses. 3. Shrub desert - 49% of park area. Low, hot country adjacent to river floodplain and below the grasslands. Plants in this zone are mostly succulents and small, widely-spaced shrubs such as creosotebush Larrea tridentata and various members of the cactus family. 4. River floodplain - less than 1% of park area. Lies along the Rio Grande. Plants of this belt are all water-loving species, including cottonwood Populus acuminata, giant reed Arundo donax, common reed Phragmites communis and willows Salix nigra, S. interior, S. gooddingii. Plants of rare, endemic, or otherwise interesting distribution include: Villadia squamulosa, a member of the Crassulaceae; drooping juniper Juniperus flaccida; two species of agave Agave chisoensis and A. scabra; Salvia regla; Yucca carnerosana; Hectia scariosa and Populus tremuloides. Plants of federal threatened or endangered classification include: Tobusch's cactus Ancistrocactus tobuschii, Mariposa cactus Neolloydia mariposensis, cory cactus Coryphantha ramillosa. Plants considered as candidates for threatened/endangered listing include: mariscal cholla Opuntia imbricata var. argentea, chisos pitaya Echinocereus reichenbachii var. chisosensis, button cactus Epithelantha bokei, cob cactus Coryphantha strobiliformis var. durispina, longspur columbine Aquilegia longissima and Big Bend bluegrass Poa involuta.

FAUNA The Carmen white-tailed deer Odocoileus virginianus carminus is found in the woodlands of Big Bend and vicinity and nowhere else in the United States. The endangered peregrine falcon Falco peregrinus anatum nests in cliff eyries along the river and in the Chisos Mountains. The Colima warbler Vermivora crissalis nests only in the Chisos Mountains in the United States. The black-vented oriole Icterus wagleri summers along the river in Big Bend, which is the only known occurrence of the species in the United States. Reptiles and amphibians include the reticulated gecko Coleonyx reticulatus, recently described and considered very rare, cliff frog Syrrhophus marnocki, Texas alligator lizard Gerrhonotus liocephalus infernalis and Davis Mountain kingsnake Lampropeltis mexicana alterna. Two land snails are endemic to Big Bend - Humboltiana edithae and Holospira yucatensis. Two endemic fish, the Chihuahuan shiner Notropis chihuahua and Gambusia gaigeil, are found only in or near the Rio Grande. Animals of threatened or endangered classification include: Big Bend gambusia Gambusia gaigei, American peregrine falcon Falco peregrinus anatum.

ZONING/CONSERVATION MANAGEMENT Within Big Bend National Park there are three major zones: Natural, Development and Historic. The vast majority of the park's 287,572ha are managed as a Natural Zone, of which 216,069ha are classified and managed as a wilderness subzone. The Pine Canyon Research Natural Area is classified and managed as an Environmental Protection subzone. Approximately 81ha are classified as a Development Zone and managed to serve relatively large numbers of visitors. The Historic Zone is comprised of historic sites and other important cultural resources.

STAFF Administration: five; interpretation: three; protection: 11; maintenance: 24. The staff increases with a varying number of seasonal or temporary employees, usually hired during the busy summer season.

LOCAL ADMINISTRATION Superintendent, Big Bend National Park, Texas 79834, USA.

VISITOR FACILITIES Campgrounds, hiking-trails, evening talks, lodge, food service, trailer parks, pinic tables, showers, stores, service stations, public telephones, post office, rental saddle horses and park animals, laundry and restrooms exist.

SCIENTIFIC RESEARCH AND FACILITIES Big Bend National Park comprises a prime desert ecosystem. Short-term research projects on plants and animals and geological surveys are currently under way in Big Bend. In addition, 15-20 long-range studies are in progress. Especially needed is investigation of the Chisos woodland as a relict forest. This is being incorporated in research leading to a fire management plan for the area. There are two research stations located within the park which are used fairly constantly by researchers. At park headquarters there is a small library, and study collections are available for use.

MODIFICATION OF THE NATURAL ENVIRONMENT Previous disturbances include mining, grazing, logging, and farming. Alterations of land and flora prior to 1944, especially those resulting from overgrazing, are still in evidence. The park is open to the public, and receives over 300,000 visitors per year. Facilities within the park include campgrounds, eating and lodge facilities, gasoline stations, grocery stores, trailer parks, orientation stations, roads, both paved and gravel, and trails. Developments are concentrated in four main areas of the park, each of which also contains employee housing. A large percentage of visitor use is currently concentrated in the Chisos Mountains, a relatively small and easily impacted area.

PRINCIPAL REFERENCE MATERIAL

There are many books, theses, and papers on the Big Bend area. A few of the most well-known publications include:

Lonsdale, Hazard and Maxwell. Geology of Big Bend National Park.
McDougall and Sperry. Plants of Big Bend National Park.
Madison. The Big Bend Country of Texas.
Maxwell. The Big Bend of the Rio Grande.
Warnock. Wildflowers of the Big Bend Country, Texas.
Wauer. Birds of Big Bend and Vicinity.

Cascade Head Experimental Forest and Scenic Research Area

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION Cascade Head Experimental Forest is subject to laws applicable to National Forest lands plus special designation as research property under Forest Service Regulation U4 (dedication to research and education). Cascade Head Scenic Research Area established by Congress in 1974 (Public Law 93-535).

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION On the Pacific coast in the state of Oregon. Approximately 15km north of Lincoln City, Oregon, 90km south-west of Portland, Oregon. 45°02'N, 123°59'W.

ALTITUDE 0-525m

AREA The biosphere reserve covers an area of 7,051ha. Cascade Head Experimental Forest: 4,756ha; Scenic Research Area: 3,868ha (including 1,573ha of Experimental Forest).

LAND TENURE Approximately 4,600ha federally owned and 226ha owned by the state of Oregon and county governments; remainder privately owned at present but partially in process of federal acquisition.

PHYSICAL FEATURES Rugged basaltic headland with moderate to steep slopes and numerous sea cliffs adjacent to estuary with tidal flats and surrounding gentle hills of sedimentary materials. Warm, wet winters with cool summers. Average precipitation 2480mm. Frequent summer fogs.

VEGETATION Dominant biological features are the dense, extremely productive Pices sitchensis-Tsuga heterophylla forests, estuary and associated salt marshes, stands of Alnus rubra, grassy headland areas, beaches and sea cliffs. Very high biomass (more than 1000 tons/ha) and productivity (as much as 37 tons/ha/year net) recorded.

FAUNA The predatory component of the fauna not intact but exact status not known.

ZONING/CONSERVATION MANAGEMENT Complex zoning procedures based on six sub-areas: estuary and associated wetlands, headlands, upper timbered slopes, coastline, sand dune-spit, and lower slope. Experimental Forest zoned for various kinds of research: Control (to remain undisturbed), Experimental Reserve, and Manipulative Areas. Cascade Head Scenic Research Area was established in 1974; 1) in order to provide for present and future use and enjoyment of the area; 2) to insure protection for and encourage research and scientific study; and 3) to promote a more sensitive relationship between man and the environment.

STAFF Estimated at about eight man years in 1976, of which 1.5 were for research; expansion in both administration and research expected.

LOCAL ADMINISTRATION Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Most intensive studies are of Picea sitchensis-Tsuga heterophylla forest in biogeographical province. Includes work on growth and yield of forests, cutting methods and regeneration of trees, and nutrient cycling including effects of Alnus on the nitrogen regime. Potential very high for environmental baseline monitoring (coastal location), research on estuaries and saltmarshes (including restoration) and ecology and management of Picea-Tsuga and Alnus forests.

MODIFICATION OF THE NATURAL ENVIRONMENT Approximately 30% of the Experimental Forest has been subject to logging and 60km of road constructed as part of research and experimentation on silvicultural practices. Scenic Research Area (outside Experimental Forest) has been subject to varying degrees of human modification from little to substantial (residences, diking of marshlands, clearing for agriculture, etc.).

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Central Plains Experimental Range (CPER)

BIOGEOGRAPHICAL PROVINCE 1.18.11 (Grasslands)

LEGAL PROTECTION Land is administered by the Agricultural Research Service (ARS), U.S. Department of Agriculture, as a range research unit.

DATE ESTABLISHED Approved in June 1976 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Located in western central Great Plains in north-east Colorado; 14km south of Colorado-Wyoming border and 40km south of Cheyenne, Wyoming; bisected by Owl Creek; bounded on west by US Highway 85. 40°50'N, 104°45'W.

ALTITUDE 1,600-1,690m

AREA The Biosphere Reserves covers an area of 6,210ha, not including 502ha of surrounded privately owned lands.

LAND TENURE Federal government owns 95% of the area; 5% is private land under relatively stable control of ARS.

PHYSICAL FEATURES The range is on Colorado Piedmont, created by erosion of the High Plains surface. Exposed surfaces are primarily Tertiary sediments. Soils are Arguistolls-Haplagids-Paleustolls and are predominately loams, sandy loams, and clay loams formed on shale and siltstone outcrops of Pierre sedimentary formation or on fluvial outwash materials. Topography is mostly gently rolling plains, but includes eroded breaks and buttes. Mean annual

precipitation is 310mm; the range is 110 to 580mm; and 85% occurs during May through September. Mean monthly temperatures range from a low of -12°C in January to a high of 30°C in July, mean freeze-free season is 133 days.

VEGETATION Vegetation is that of the shortgrass prairie. Bouteloua gracilis is the predominant grass. Other more important grasses include Sporobolus cryptandrus, Aristida longiseta, Buchloe dactyloides, Agropyron smithii comata, Sitanion hystrix and Distichlis stricta. Important forbs include Sphaeralcea coccinea, Psoralea tenuiflora, Eriogonum effusum, Gaura coccinea and Salsola kali tenuifolia. Atriplex canescens and Opuntia polyacantha are important shrubs. Several areas were farmed and have revegetated naturally.

FAUNA Common mammals are Bos taurus, Antilocapra american, Lepus townsendii, L. californicus, Spermophilus tridecemlineatus, Onycomys leucogaster, Dipodomys ordii and Peromyscus maniculatus. The most common birds are Calamospiza melanocorys and Eremophila alpestris. Eagles, hawks and Eupoda montana are noteworthy. Most common snakes are Thamnophis radix, Pituophis catenifer, Cortalus viridis and Heterodon nasicus. Grasshoppers and beetles are the most common invertebrates.

ZONING/CONSERVATION MANAGEMENT The range is not zoned

STAFF Scientific: ARS four, NREL two; Technical: ARS six, NREL two; Support: ARS two. Seasonal staff: Scientific five-15; Technical four; Support seven.

LOCAL ADMINISTRATION Officer-in-Charge of Central Plains Experimental Range, Agricultural Research Service, USDA, Crops Research Laboratory, Colorado State University, Fort Collins, Colorado 80523, USA.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Because there is an abundance of research results for the Range that cover a considerable amount of normally preliminary research, a tremendous potential exists for advanced and productive studies. From 1939 to 1961 the U.S. Forest Service, and from 1961 to the present the ARS, conducted ecological, revegetation, range improvement, grazing management, and related range research on the Range. Since 1968, the Grassland Biome of the U.S. International Biological Program (IBP) and its successor, the Natural Resource Ecology Laboratory (NREL) of Colorado State University, have conducted research on the fundamental structural and functional characteristics of the ecosystems and on modelling of the data. There are numerous 0.8ha grazing enclosures and a set of pastures grazed since 1939 at light, moderate and heavy intensities. Grazing history of most pastures is known. Detailed weather-related data are collected and a network of rain gauges are monitored. NREL maintains several microwatersheds and a soil lysimeter. ARS maintains a field headquarters and several cattle facilities. NREL maintains a field headquarters which includes office, laboratories, dining facilities, house, dormitory, storage-workspace and corrals. NREL is currently negotiating with the U.S. National Science Foundation for a contract to provide support service at NREL's Pawnee Site on CPER for a Biological Research Reserve. Many basic and practical problems remain to be solved and there exist the facilities and atmosphere for their study.

MODIFICATION OF THE NATURAL ENVIRONMENT No information

PRINCIPAL REFERENCE MATERIAL
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Channel Islands Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.07.06 (Californian)

LEGAL PROTECTION Anacapa, San Miguel and Santa Barbara Islands have total protection. All archaeological, biological, geological and historic features are protected, with the exception of game fish species. Santa Cruz and Santa Rosa Islands are privately owned and support ranching and hunting activities. Marine resources are under the State of California's jurisdiction, as are the commercial and sport harvesting of some marine species. The islands are administered under the guidelines for Natural Areas by the U.S. National Park Service.

DATE ESTABLISHED The park was established as Channel Islands National Monument in 1938, then was enlarged as the Channel Islands National Park on 5 March 1980. Accepted as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION The park comprises five of the eight California Channel Islands (Anacapa, San Miguel, Santa Barbara, Santa Cruz, Santa Rosa), together with the surrounding ocean for six nautical miles around each. Anacapa is part of Ventura County, the others lie in Santa Barbara County. 33°27'-34°04'N, 119°01'-120°26'W.

ALTITUDE Sea level to 283m (Anacapa); 253m (San Miguel); 193m (Santa Barbara); 741m (Santa Cruz); and 479m (Santa Rosa).

AREA The 479,625ha Channel Islands National Marine Sanctuary comprises the Channel Islands National Park: Anacapa 284ha; San Miguel 3,777ha; Santa Barbara 362ha; Santa Cruz 24,561ha; Santa Rosa 21,383ha; protected ocean area 432,258ha.

LAND TENURE Anacapa, San Miguel and Santa Barbara are under Federal Government ownership of which approximately 16% is administered by the U.S. Coast Guard and 84% by the National Park Service. Santa Cruz and Santa Rosa are owned privately by individuals and a conservation organisation; although the Federal Government is scheduled to purchase all of Santa Rosa and about a tenth of Santa Cruz, and to cooperate in management of the remaining nine tenths of that island.

PHYSICAL FEATURES The northern four islands (Anacapa, Santa Cruz, Santa Rosa and San Miguel) extend in an east-west directed chain, parallel to the Ventura and Santa Barbara County coastline. They are an extension of the mainland Santa Monica Mountains; one of the transverse ranges formed by geological faulting in the Miocene. The most commonly-held hypothesis is that these islands were never linked to the mainland by a land bridge, but rather were joined with each other as one large island called 'Santarosea' some 17,000 years ago during the Pleistocene epoch, when the sea level was at its lowest.

The bedrock varies from igneous to sedimentary material in varying proportions. Topography differs greatly between islands. Anacapa consists of gently rolling plateaux (on three islets) atop almost sheer cliffs; Santa Cruz and Santa Rosa are relatively mountainous and have numerous stream courses; and San Miguel consists of low hills dissected by canyons. Santa Barbara Island is not thought to be closely related geologically to any other island and is not thought to have been connected to the mainland. It has a bedrock of igneous origin and there is clear evidence of extensive marine terracing. Topographically the island consists of two peaks connected by a low ridge, with gradual terraces on either slope. The islands also represent examples of some of the most extensive marine terraces in the world and contain many sea caves, rugged shorelines, sandy beaches, mountain peaks, and valleys. Eolian land forms with active dunes and sand castings of ancient forests, known as caliche, are also present. These unusual deposists are among the most interesting of the geological features found on the islands. The islands experience Mediterranean weather patterns, with most of the precipitation occurring in winter in the form of rainstorms, with dry (though occasionally foggy) summers; precipitation averages between less than 500mm to almost 600mm, depending on the island. Temperatures range between maximums of 20-30°C in summer and minimums of -2-8°C in winter, mean temperature air 19°C, mean sea temperature 14°C; with the interior regions of the larger islands recording the greatest extremes.

VEGETATION The islands represent the last examples of natural Mediterranean ecosystems in North America. The reserve also contains some of the few remaining natural southern California coastal ecosystems, including coastal sage communities on the islands and exceptionally pristine tidepools on the marine terraces surrounding them. In addition, the park lies on the boundary between two major coastal marine biogeographical provinces: the Oregonian-Temperate Eastern Pacific province to north and the Californian-Subtropical Eastern Pacific province to the south (U.S. MAB Report No. 6, 1981). The western islands of the park, San Miguel and Santa Rosa, are bathed by cold northern waters carried south by the Californian current and therefore reflect the biological assemblages of the Oregonian-Temperate Eastern Pacific province. Waters around the eastern islands of Anacapa and Santa Barbara came from the south along the mainland coast and support warm temperate biota characteristic of the Californian-Subtropical Eastern Pacific province. Around Santa Cruz Island, at the boundary of these two provinces, there is a broad transition zone where plants and animals from both regions mingle and create a special assemblage of species that are capable of adapting to the unique and variable conditions of the transition zone. In addition to this unique transition zone, reserve waters harbour species assemblages that are representative of nearby 1,600km of North American coast from Ensenada, Mexico to San Francisco. Several plant communities, including coastal strand, coastal bluffs, grasslands, coastal sage scrub, chaparral, woodlands, pine forest and riparian and marsh habitats, occur on one or more of the islands. Interesting native plants include trees such as Santa Cruz Island ironwood Lyonothamnus floribundus asplenifolius, Santa Cruz Island pine Pinus remorata, Torrey pine Pinus torreyana, Catalina Island cherry Prunus illicifolia lyonii, island oak Quercus tomentella, Coreopsis gigantea and Dudleya spp.. Over 80 endemic plants have been identified, and there are several candidate, proposed or listed species under the Federal Endangered Species Act of 1973. The various Mesembryanthemum spp. are the most widespread introduced plants on the islands; there is some fear that they are crowding out native plant species. One of the more permanent marine communities surrounding the islands is the giant kelp Macrocyslis pyrifera forest, which occurs in relatively shallow rocky bottom areas. 40% of the kelp beds in southern California are found in the reserve. The kelp beds provide food and shelter for over 125 fish species, and habitat for over 800 other species of annimal and plant. A species list for the reserve is available.

FAUNA Native terrestrial mammals are few, but include, deer mouse Peromyscus maniculatus on all islands, island fox Urocyon littoralis on the three largest islands, spotted skunk Spilogale gracilis on the two largest islands, and several species of bat. Introduced Rattus rattus is present on Anacapa and Oryctolagus cuniculus is present on Santa Barbara Island. Sea mammals include California sea lion Zalophus californianus, harbour seal Phoca vitulina, northern elephant seal Mirounga angustirostris and northern fur seal Callorhinus ursinus (once eradicated from the Channel Islands vicinity), Guadelupe fur seal Arctocephalus townsendi and the southern sea otter Enhydra lutris; the latter two are both federally listed species slowly returning to the area. 27 species of cetaceans have been recorded, including California the park grey whale Eschrichtius gibbosus, which migrates through this area. Resident terrestrial bird species are fewer in number than in like habitats on the adjacent mainland, though many more visit the islands during migration. A few varieties, including the island scrub jay Aphelocoma coerulescens insularis, have been classified as endemic to one or more islands. Species once breeding on the islands, but no longer nesting, include the bald eagle Haliaeetus leucocephalus leucocephalus (E), puffin Lunda cirrhata and peregrine falcon Falco peregrinus (V). Several species of seabirds nest on the islands and surrounding rocks and islets, including various alcids, cormorants and petrels, as well as the western gull Larus occidentalis. A rare breeder in most of the United States, brown pelican Pelicanus occidentalis, is a common nesting resident on Anacapa Island. Few species of amphibians and reptiles inhabit the islands, but one frog, two salamanders, four lizards and four snakes occupy one or more of the islands. The island night lizard Xantusia riversiana (federally listed as Threatened) is endemic to the islands. Interesting terrestrial invertebrates include, globose dune beetle Coelus globosus and several species of mollusc, such as slug snail Binneya notabilis. No freshwater fish are native to the islands, but ocean waters within the park boundary provide habitat to many marine species including giant sea bass Stereolepis gigas, garibaldi Hypsypops rubicundus, northern anchovy Engraulis mordax, sheephead Pimelometopon pulchrum and white shark Carcharodon carcharias. Important invertebrates in these waters include abalone Haliotis spp, purple urchins Strongylocentrotus purpuratus and spiny lobster Panulirus interruptus. A species list for the reserve is available.

CULTURAL HERITAGE The islands are also significant for their fossil discoveries and cultural values. Fossil remnants of an endemic dwarf mammoth, a giant mouse and an extinct species of gannet have been discovered on Santa Rosa and San Miguel Islands. The islands are rich in archaeological values and thousands of midden and village sites of the sea-faring Native American Chumash and Garielino people and their ancestors are found on island sites; some of these date back 40,000 years could possible indicate the earliest known evidence of man in North America. San Miguel is thought to be the burial place of Juan Rodriquez Cabrillo, who was the first European to discover California in 1542. Other historic sites of particular interest are the remains of the Nidever Adobe on San Miguel and the Coast Guard settlement on East Anacapa Island, both of which are on the National Park Service List of Classified Structures. Other notable historical structures can also be found on Santa Cruz Island and Santa Rosa Islands.

ZONING/CONSERVATION MANAGEMENT Management zoning is used in Channel Islands National park to prescribe areas where certain desired conditions are to be achieved and where certain uses may be provided. Of these, 'Development and Special Use' zones occupy at the most 1% of the land on those three islands; the 'Natural' zone (including 'Natural Environment' and 'Protected Natural Area' sub-zones) occupying the remainder. The most stringently protected of these is the Research Natural Area on West Anacapa, which may be visited only

for bona fide research reasons and even then not during the pelican nesting season. An 'Historic' zone (including 'Preservation' and 'Preservation/ Adaptive Use' sub-zones), overlapping other management zones, covers 99%. These Historic zones are managed to interpret and preserve archaeological, cultural or historic features and include the U.S. Coast Guard light station on Anacapa and American Indian midden sites. In 1975 the Channel Islands National Monument Resource Management Plan was approved; it outlined priority projects in both the research and management fields for the monument, many of which were concerned with returning the islands to a more natural state. A management plan for the Biosphere Reserve has been drawn up by National Park Service of the U.S. Department of the Interior. It includes detailed recommendations for management and development of the Reserve.

STAFF There is a permanent staff of 21 comprising, five administration, 11 visitors services and resource management, one researcher and four maintenance. In addition, the on-site manager for the Channel Island National Marine Sanctuary is stationed at the park. Four university trained park rangers assist the manager in fieldwork. Two research scientists are assigned to the reserve. The staff is supplemented by seasonal help.

LOCAL ADMINISTRATION Superintendent, Channel Islands National Park, 1901 Spinnaker Drive, Ventura, California 93001.
Chief, Sanctuary Programs Division, Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, 3300 Whitehaven Street, N.W., Washington, DC 20235, USA.

SCIENTIFIC RESEARCH AND FACILITIES Both cultural and natural research programs have been undertaken, primarily as independent projects, for several years under National Park Service guidelines. These include, long-term monitoring of brown pelicans on Anacapa, pinnipeds studies on San Miguel and western gulls on Santa Barbara. Additionally, research projects have been carried on for many years on the privately owned islands under the auspices of the landowners involved. Currently, as directed by the park establishing legislation, the National Park Service is developing various monitoring projects for both marine and terrestrial wildlife resources. The National Park Service is interested in cooperating with legitimate researchers however it can, and the local administration aids approved research groups with logistics where possible. Except for a research station run by the National Marine Fisheries Service on San Miguel for the exclusive use of that agency's personnel, no facilities are present on the islands managed by the National Park Service. The University of California operates a research station with group facilities for independent investigators on the portion of Santa Cruz island which is scheduled to remain under private ownership; information may be obtained through the Santa Barbara campus. Limited camping facilities are available on Santa Barbara and Aracapa Islands. Access is entirely by boat, except for limited administrative/emergency aircraft service. The closest ports are Los Angeles, Port Hueneme, Oxnard, Ventiva, and Santa Barbara.

MODIFICATION OF THE NATURAL ENVIRONMENT All of the islands have been altered to a greater or lesser extent by activities of recent man, including accidental fires, farming and livestock grazing. Anacapa has been physically modified by man at Frenchy's Cove (on West Island) by terracing for buildings, but the most disturbed portion of Anacapa is East Island, which, from 1932 to 1969, was a U.S. Coast Guard installation; there are still numerous buildings and roads on this small islet. Many dominant plant species have been introduced (including several species of annual grasses), and the South African iceplant Mesembryanthemum). Introduced animals include the black rat Rattus rattus, European rabbit Oryctolagus cuniculus, domestic pig Sus sp.,

domestic sheep Ovis sp., elk Alces alces and mule deer Odocoileus hemionus, which all adversely affect the islands' ecosystems to varying degrees. Manipulative research on exotic plants and animals is underway to determine their impacts and to develop effective management actions to eliminate their impacts. Feral rabbits and burros were successfully removed from Santa Barbara and San Miguel Islands within the past ten years. Outside influences with the same potential effect include oil and gas development, the close emplacement of a liquid natural gas terminal, sonic booms from the space shuttle program, and disturbance from uncontrolled visitor use. Fisheries harvests are regulated by the State of California. Over 180,000 people visited the national park in 1982.

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Coram Experimental Forest (including Coram Natural Area)

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION Complete protection of Coram Natural Area except for wildfire.

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Located in Flathead National Forest, 13km south of the west entrance to Glacier National Park, 1.5km north-east of the Hungry Horse Dam, Montana; Martin City lies 3km west. 48°22'-26'N, 113°58'-114°00'W.

ALTITUDE 1067-1920m

AREA 3,019ha

LAND TENURE Ownership by U.S. Forest Service, managed by Intermountain Forest and Range Experiment Station and Flathead National Forest.

PHYSICAL FEATURES Klages et al. (1976) described the physical features as follows: "Bedrock underlying the soils on the mountain slopes is mapped as Missoula group, Belt supergroup (late Precambrian) sedimentary rocks. It includes red, maroon and purple argillite, sandy or quartzitic argillite, and quartzite. In some places impure limestone and dolomite of the Siyeh formation and calcareous siliceous argillite of the lower Piegan formation may be included. Bedrock under the lower elevation areas in the west and southwestern parts of the Experimental Forest are Kishenehn formation Tertiary sediments. It inclues siltstone, silty sandstone, locally carbonaceous shale, indurated conglomerate, and reddish shale". "Slopes along Abbott Creek and its south fork up to about 4100ft (1242m) elevation include glacial drift and morainal and outwash deposits of mountain glaciers of the Middle and South Fork Flathead lobes which are associated with or overlie Kishenehn sediments. Steep mountain slopes north of Abbott Creek and at higher elevations on the east side of the area were probably light glaciated. Much of the area was also covered by a thin layer of volcanic ash". "Landforms include stream and glacial till deposits on mountain slopes and unglaciated mountain slopes underlain by bedrock at depths from 2 to 4ft". Precipitation averages 790mm at lower elevations. Mean temperatures are about 16°C May through August, with occasional readings of 38°C. Temperatures hover near -7°C during December through February but often drop to -29°C.

VEGETATION The forest types are chiefly Larix occidentalis and Pseudotsuga menziesii var. glauca. Besides these tree species, the following conifers are also present: Abies lasiocarpa, Picea engelmannii, Pinus contorta, Tsuga heterophylla, Thuja plicata and Pinus ponderosa. Common shrubs include Acer glabrum, Alnus sinuata, Amelanchier alnifolia, Cornus stolonifera, Menziesia ferruginea, Olopanax horridum, Pachistima myrsinites, Physocarpus malvaceus, Rosa woodsii, Vaccinium globulare and V. scoparium.

FAUNA Dendrogapus obscurus, Eanachites canadensis, Bonasa umbellus, Junco spp., Nucifraga columbiana, Corvus spp., Ursus americanus, U. horribilis, Eutamias spp., Canis latrans, Odocoileus hemionus, O. virginianus, Cervus canadensis, Citellus spp., Alces americana, Peromyscus maniculatus, Erethizon dorsatum, Clethrionomys spp.. The area is hunted heavily for deer, elk and grouse.

ZONING/CONSERVATION MANAGEMENT Entire experimental forest designated for research purposes; no disturbance allowed in the Coram Natural Area. No buffer zone around the experimental forest. Managed for research of timber management activities; no grazing of livestock nor firewood cutting permitted.

STAFF A scientist and a technician are assigned responsibility of coordinating research and protection activities. Personnel of the Flathead National Forest provide most of the fire protection and road maintenance and assist in the timber sales program.

LOCAL ADMINISTRATION Forestry Sciences Laboratory, Intermountain Forest & Range Experiment Station, PO Box 1376, Bozeman, Montana 59715, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The Coram Experimental Forest is included in the initial proposed network of Experimental Ecological Reserves. The site quality is excellent for purposes of ecological research. The representation of different biotic components on the site includes a variety of age classes (although old growth (300-500 years) and age classes under 80 years predominate) and forest associations. An excellent opportunity is available for comparative experimental research. The Coram Natural Area as a control is a positive feature of this site. Applied research programs are currently extensive but additional use of this control area can be made if basic ecological studies were incorporated into the management plan. The Coram Experimental Forest serves as a classroom for students, researchers and land managers from federal, state, and private organizations as well as for foreign visitors. All research plots are easily reached during May to October from high quality forest roads. Limited research facilities are available.

MODIFICATION OF THE NATURAL ENVIRONMENT About 30% of the area has been cut-over and the remainder is largely undisturbed forest. All of the forest except for the natural area is available for study of management activities in western larch forest. Most cut-over areas have been restocked with conifers and most contain study plots following the growth of these young stands. Because of its close proximity to towns it is heavily used by berry pickers and hunters. A major forest highway passes diagonally through the south-west quarter from Martin City to Spotted Bear at the south end of Hungry Horse reservoir.

PRINCIPAL REFERENCE MATERIAL

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Coweeta Hydrologic Laboratory

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern Forest)

LEGAL PROTECTION Federal, United States Department of Agriculture (USDA), Forest Service, Southeastern Forest Experiment Station; site dedicated to research including areas designated for manipulation and areas designated as control or undisturbed. Vehicle access to the area can be regulated, but the area is open to regulation hunting and fishing seasons.

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION In southern Appalachian Mountains of western North Carolina, 20km south of Franklin, N.C.; drainage to the Little Tennessee River. 35°03'N, 83°27'W.

ALTITUDE 679-1592m

AREA 2,158ha

LAND TENURE Federal government. Administered by USDA, U.S. Forest Service.

PHYSICAL FEATURES The area lies within the Blue Ridge geological province, and contains the following rock groups: Coweeta Persimmon Creek gneiss, Coleman River formation and Ridgepole Mountain formation. Granite, gneiss, schist and mica are predominant. The regolith depth varies between 0-30m and averages 10m. The soils include Dystrochrept and Hapludult classifications with loam, sandy loam and stony loam textures. The topography is diverse and includes valley bottoms, coves, different slope positions, and ridges. Sites vary from very high to very low productivity. Approximately 50km of streams drain the area and include first through to third order drainages. Precipitation is high and variable over the area with an average of 178cm at lower elevations to over 250cm on the upper slopes; distribution is relatively uniform with an average of 9cm in October as the driest month and 20cm in March, the wettest. Mean annual temperature averages 13°C; the coldest month is January, with a mean temperature of 3.5°C, and July is the warmest month, with a mean of 21°C.

VEGETATION Mixed, deciduous hardwoods of varying age structure cover the area. The dominant type includes Quercus, Carya, Acer, Liriodendron, Betula, Cornus, Pinus, Kalmia and Rhododendron. Past experimental manipulations have resulted in Pinus plantations and early successional stands of hardwoods. Castanea dentata was once a major component of the mature forest stand, but owing to blight caused by the fungus Endothia parasitica, this species has been virtually eliminated. Forest composition and structure are still changing because of this natural disturbance.

FAUNA White-tailed deer Odocoileus virginianus, black bear Ursus americanus, grey squirrel Sciurus carolinensis, raccoon Procyon lotor, ruffed grouse Bonasa umbellus and other indigenous animals are common in this area. Heavy infestation of two defoliators Ennos subsignarius and Alsophila pometaria has been observed and small outbreaks of Dendroctonus frontalis have occurred. New species of Psilotneta and Pterostichus have been found in the area. Species of Desmognathus and Leurognethus occur over ecological gradients.

ZONING/CONSERVATION MANAGEMENT The core area consists of the Coweeta and Dryman Fork basins. Both basins have a buffer zone administered by the U.S. Forest Service, National Forests.

STAFF	Forest Service	University of Georgia		Other
		Located at Coweeta	Located at Athens, Ga.	
Scientific	4	0	7	0
Technical	5.4	2.6	4.0	1
Support	2	0	2	0

LOCAL ADMINISTRATION Coweeta Hydrologic Laboratory, PO Box 601, Franklin, N.C. 28734, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Measurements of streamflow and precipitation began in 1934; about 1,000 gauge-years of streamflow records and 2000 gauge-years of precipitation records have been collected. Data are routinely summarized into standard formats that characterize streamflow and precipitation. Other climatological data have been continuously collected and summarized. Streamflow and precipitation chemistry have been measured for

about 6 years. Vegetation and fauna surveys are also available. The mission of Forest Service research over the past 40 years has been to study the effects of forest management practices on the quantity, timing and quality of streamflow, and to develop methods and procedures for predicting and mitigating impacts. Current emphasis is on parameters of water quality. Coweeta has a history of cooperative research, and, within the past ten years, about 20 formal agreements have been initiated with universities, agencies and other institutions. Coweeta has participated in international programs, including FAO training programs; US/Internatonal Hydrological Decade; one of the five major sites of the Eastern Deciduous Forest Biome of the US/International Biological Program. Participation in IBP over the past six years has been in coordination with the Institute of Ecology, University of Georgia. The current cooperative research program with the University of Georgia is funded by the National Science Foundation, and emphasizes the processes of nutrient circulation in undisturbed and disturbed forest ecosystems. Taken collectively, past Forest Service and cooperative research provides a unique and valuable opportunity to examine ecosystem processes at different levels of complexity and to integrate findings within the framework of watershed response. Sufficient areas are available to retain undisturbed watersheds while applying manipulation to other watersheds to test hypotheses. Dryman Fork, a 559ha basin, is more isolated than the Coweeta Basin, and no experimental manipulations have occurred in the area; excellent potential gauging sites exist. The primary facilities needed are office space for visiting scientists and general purpose laboratory space. Weir structures for gauging new areas are needed and access roads to gauging sites would also facilitate research.

MODIFICATION OF THE NATURAL ENVIRONMENT Relatively undisturbed forests (since 1927) occupy about 1,600ha, while manipulations include old field (13ha), white pine plantations (33ha), coppice stands resulting from clearcutting at different elevations (62ha), a watershed demonstration of multiple use including thinning (144ha), strip cut and selection cuts (200ha), and other manmade openings (100ha). No recreation or tourist sites are located within the core area, but the heavily used Appalachian Trail traverses about 6km of the upper watershed boundary. Timber harvest by U.S. Forest Service is the primary modification within the buffer zone. Several homes are located along Coweeta Creek in the valley leading to the experimental station.

PRINCIPAL REFERENCE MATERIAL

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Denali National Park and Biosphere Reserve: Denali National Park Unit

BIOGEOGRAPHICAL PROVINCE 1.03.03 (Yukon taiga)

LEGAL PROTECTION Total protection for 35% of the area, some subsistence hunting, trapping and mining (prior rights) permitted 43% and sport and subsistence hunting and trapping permitted 22%.

DATE ESTABLISHED Approved in 26 February 1917 as a National Park; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION South central Alaska centred on the Alaska Range which separates the coastal lowland from the interior. 63°20'N, 150°30'W.

ALTITUDE 122-6,194m

AREA The biosphere reserve covers 2,441,295ha, including 782,000ha Mount McKinley National Park.

LAND TENURE Federal government ownership excluding small mine and private inholdings.

PHYSICAL FEATURES Denali has a unique and spectacular combination of geologic features including major tectonic faults, active glaciers, features associated with permafrost and Mount McKinley, the highest peak in North America towering 4800m above the surrounding landscape. Numerous iceflows radiate from the peaks the longest being the 72km Kahiltna Glacier. The Denali fault system the largest crustal break in North America, stretching 2,000km across Alaska and associated with the Alaska Range crosses the park separating the older from much younger peaks. North of the Alaska Range are foothills with a broad region of lowlands beyond containing numerous rivers, lakes, bogs and forests. The park contains two of the major climatic zones of Alaska, separated by the Alaska Range which forms a barrier to the coastal winds bringing moisture from the Pacific Ocean and Gulf of Alaska. North of the range the climate is continental, hotter in summer and colder in winter than the area south of the range. Temperatures vary from -50°C to 30°C. Annual precipitation ranges from 350mm in the north to 1000mm or more in the mountains on the south flanks of the Alaska Range.

VEGETATION The treeline occurs at 823m. Warm dry south-facing slopes adjacent to rivers have white spruce Picea glauca with paper birch Betula papyrifera, balsam poplar Populus balsamifera and quaking aspen P. tremuloides and a ground cover of ericaceous shrubs and mosses. North-facing permafrost-underlain slopes and lowlands have black spruce P. mariana with paper birch, white spruce, tamarack Larix laricina and ericaceous shrubs, mosses, sedges and grasses. Moist foothill tundra comprises cottongrass Eriophorum sp. with dwarf shrubs, green alder Alnus crispa and dwarf birch Betula nana. Drier tundra has mats of mountain avens Dryas spp., grasses and sedges. Above the alpine tundra, rock, snow and ice dominate.

FAUNA Thirty-seven mammal species including wolf Canis lupus, red fox Vulpes v. fulva, grizzly bear Ursus arctos, wolverine Gulo gulo, Canadian lynx Lynx canadensis, Alaska moose Alces alces, barrenground caribou Rangifer tarandus, Dall sheep Ovis dalli and beavers Castor canadensis. 130 recorded bird species including gyrfalcons Falco rusticolus, trumpeter swan Olor buccinator, spruce grouse Canachites canadensis, ruffed grouse Bonasa umbellus and willow, rock and white-tailed ptarmigan Lagopus lagopus, L. mutus and L. leucurus. Long-distance migrants include golden plover Pluvialis dominica, long-tailed jaeger Stercorarius longicaudus, arctic tern Sterna paradisaea, wheatear Oenanthe oenanthe and arctic warbler Phylloscopus borealis.

ZONING/CONSERVATION MANAGEMENT Most of the area is a natural zone.

STAFF Nineteen full-time (superintendent, seven rangers, nine maintenance and two administrative) and about 100 seasonal employees in summer.

LOCAL ADMINISTRATION Superintendent, Denali National Park and Preserve, PO Box 9, McKinley Park, Alaska 99755.

VISITOR FACILITIES Campsites, lodging, food services, groceries, supplies and gasoline are available in the reserve.

SCIENTIFIC RESEARCH AND FACILITIES Some 12 current projects including ecology of large mammals, raptor biology, vegetation mapping, human recreational impact to resources, air and water quality, geology and archaeology and several continuous monitoring programs. Earl H. Pilgrim Mining Research Field Laboratory and some field cabins.

MODIFICATION OF THE NATURAL ENVIRONMENT Manipulation is prohibited even to increase productivity in areas where hunting and trapping are allowed. Mining and visitor-use developments occupy minor amounts of land. Mining on previous valid claims can continue. Regional land use and development policies affect park ecosystem processes, natural fire and wildlife movements. Increased recreational use of wilderness is having some impact.

PRINCIPAL REFERENCE MATERIAL
Contained and indexed in the park library but a comprehensive bibliography does not yet exist.

Denali National Park and Biosphere Reserve: Mount McKinley National Park Unit

BIOGEOGRAPHICAL PROVINCE 1.03.03 (Yukon taiga)

LEGAL PROTECTION Total excluding prospecting and mining permitted under the act which established the park.

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION South central Alaska in the Alaska Range which separates the coastal lowland and Alaska's northern interior. Part of Denali National Park. 63°20'N, 150°30'W.

ALTITUDE 457-6,194m

AREA 782,000ha

LAND TENURE Federal government

PHYSICAL FEATURES The physical features are a unique and spectacular combination of geological features ranging from major earthquake faults and active glaciers to Mount McKinley, the highest peak in North America. McKinley's summit crowned by twin peaks is at 6,194m and towers above the surrounding landscape by 4,800m. The park includes ancient sea beds, young mountains with various features associated with permafrost and strong seasonal frost cycles. The geology features a portion of the Denali Fault System which is the largest crustal break in North America stretching 2,000km across the full width of Alaska. The fault is associated with the Alaska Range and passes through the park separating Alaska's most ancient rocks from those of

much younger age. Numerous ice flows radiate from the higher peaks. The longest glacier is the 56km Muldrow Glacier.

VEGETATION The timberline occurs at 823m but most forest stands are mixtures of two or more tree species and are classified by the dominant white spruce Picea glauca found on warm dry south-facing hillsides and adjacent to rivers where drainage is good and permafrost lacking. Common tree associates are paper birch Betula papyrifera, balsam poplar Populus balsamifera and quaking aspen P. tremuloides. Common shrubs include Empetrum nigrum, Ledum decumbens, Rosa acicularis, Salix spp., Vaccinium vitis-idaea and V. uliginosum. The forest floor is usually carpeted with a thick moss mat. Black spruce Picea mariana usually occurs on north-facing slopes, poorly drained lowlands and areas underlain by permafrost. A thick moss mat often sphagnum moss, sedges, grasses and heath or ericaceous shrubs comprises the subordinate vegetation. Woody plants of this association include paper birch Betula papyrifera, white spruce Picea glauca, tamarack Larix laricina, Arctostaphylus rubra, Empetrum nigrum, Ledum groenlandicum, Salix spp., Vaccinium uliginosum and V. vitis-idaea. The moist tundra of the foothills and lower elevations has a varied growth ranging from cottongrass Eriophorum spp. tussocks with sparse growth of other sedges and dwarf shrubs or stands where dwarf shrubs are dominant. Common plants are green alder Alnus crispa, dwarf birch Betula nana, resin birch B. glandulosa., Cassiope tetragona, Dryas integrifolia and D. octopetala, Ledum decumbens, Loiselauria procumbens, Salix spp. and Vaccinium spp.. Dry tundra on higher mountain areas and exposed ridges is characterized by low mats of Dryas spp., mat-forming herbs such as Silene acaulis, Oxytropis nigrescens and Minaurtia arctica, grasses and sedges. Above the alpine tundra rock, snow and ice dominate.

FAUNA There are 37 mammal species including Alaska moose Alces alces, barrenground caribou Rangifer tarandus, Dall sheep Ovis dalli, grizzly bear Ursus arctos, wolf Canis lupus, coyote C. latrans, red fox Vulpes fulva, wolverine Gulo hyleus and Canada lynx Lynx canadensis. 130 recorded bird species include long distance migrants such as arctic tern Sterna paradisaea, long-tailed jaeger Stercocrarius longicaudus, golden plover Pluvialis dominica, wheatear Oenanthe oenanthe and arctic warbler Phylloscopus borealis. Gallinaceous birds include ruffed grouse Bonasa umbellus, spruce grouse Canachites canadensis and willow, rock and white-tailed ptarmigans Lagopus lagopus, L. muticus and L. leucurus.

ZONING/CONSERVATION MANAGEMENT No information

STAFF Superintendent, five park rangers, one technician and eight maintenance. Seasonal: 31 uniformed and 36 maintenance employees.

LOCAL ADMINISTRATION Superintendent, Mount McKinley National Park, PO Box 9, McKinley Park, Alaska.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Current research includes impact of road use on wildlife behaviour, numbers and distribution; grizzly bear-human interactions, studies of the wolf (denning, pack social structures and impact of human backcountry use) and general biological studies of major mammals. There are no scientific facilities available.

MODIFICATION OF THE NATURAL ENVIRONMENT Prospecting and mining are allowed under the 26 February 1917 Act establishing Mount McKinley which will continue until the Act is amended. Visitor use is also a major disturbance but it is

lessened by limited accommodation and restricted private vehicle access. During summer lodging supplies are provided near the headquarters/entrance area. There are seven campgrounds (total 208 spaces) along the 140km one-way park road. During the visitor season (June-September) private vehicles have restricted access to only 72 camp spaces and a free shuttle bus service is provided to minimize traffic. Backcountry overnight use is allowed on a permit basis but certain ecologically sensitive areas are restricted or closed. 1974: 161,037 visitors with 19,660 overnight stays in established campgrounds and 10,006 overnight stays in backcountry.

PRINCIPAL REFERENCE MATERIAL

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Desert Experimental Range

BIOGEOGRAPHICAL PROVINCE 1.11.08 (Great Basin)

LEGAL PROTECTION Completely protected

DATE ESTABLISHED June 1976

GEOGRAPHICAL LOCATION On Highway U21, half way between the towns of Milford and Garrison, Utah. 38°40'N, 113°45'W.

ALTITUDE 1,547-2,565m

AREA 22,513ha

LAND TENURE Federal government

PHYSICAL FEATURES Located in Pine Valley, which is a typical valley of the Basin and Range Province. This is a hydrologically closed basin with a variety of geological materials including dolomites, quartzite, limestone and lava. Soils in the valley bottom are lacustrine deposits of sandy loams, silts and clays. Alluvial fans and bajadas are gravelly sandy loams.

VEGETATION The vegetation is typical of millions of acres of Great Basin plant communities, particularly salt-desert scrub. Included are various combinations of Sarcobatus vermiculatus, Atriplex gardneri, A. confertifolia, Eurotia lanata, Grayia spinosa, Artemisia nova, A. tridentata, Pinus edulis, Juniperus osteosperma and a wide variety of grasses and forbs.

FAUNA The fauna is typical of cold deserts of the Great Basin and includes lizards, snakes, toads, rodents, rabbits, coyotes Canis latrans, bobcats Felis rufus, antelope, deer, and a variety of birds including raptors.

ZONING/CONSERVATION MANAGEMENT The experimental range is surrounded by State and Federal lands on which the chief use is livestock grazing. Portions are utilized for experimental grazing by domestic sheep or antelope.

STAFF A scientist and a technician assigned to Desert Experimental Range. Numerous helpers work on a part-time basis.

LOCAL ADMINISTRATION Project Leader, Research Work Unit 1703, Shrub Sciences Laboratory, Intermountain Forest and Range Experiment Station, 735 North 500 East, Provo, Utah 846-1, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILTIES The area has been protected and utilized in experimental grazing programs for more than forty years. It meets the criteria for an Experimental Ecological Reserve. Long-term records of range use, vegetation change and climate are available. The area has been covered by a soil survey. It has considerable potential for ecological research and development of an understanding of how the ecosystem functions. There are no details available on scientific facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Largely undisturbed except for fences, limited road system and controlled livestock grazing.

PRINCIPAL REFERENCE MATERIAL

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Everglades National Park (including Fort Jefferson National Monument)

BIOGEOGRAPHICAL PROVINCE 8.12.04 (Everglades)

LEGAL PROTECTION Total. The 1934 Act of Congress that authorised the park was perhaps the strongest preservation mandate of any established national park in the U.S. Disturbances and exploitation prohibited by law. Sport and commercial fishing are permitted under special regulations.

DATE ESTABLISHED 6 December 1947. Biosphere Reserve, June 1976. Accepted as a World Heritage Site in 1979.

GEOGRAPHICAL LOCATION The Everglades National Park is situated on the southern tip of Florida peninsula, 14km from Florida City. The park is bounded to the west by the Gulf of Mexico, on the south and southeast by the Florida Keys and includes most of the waters of Florida Bay. The Biosphere Reserve includes Fort Jefferson National Monument, which consists of a group of seven coral reefs called the Dry Tortugas and the surrounding shoals and waters. The Monument lies 112km west of Key West in the Florida Keys. 24°50'-25°55'N and 80°20'-81°30'W.

ALTITUDE Everglades National Park 0-2m. Fort Jefferson National Monument 0-1.5m

AREA 585,867ha. Everglades 566,769ha, Fort Jefferson National Monument 19,071ha (including 16ha of land).

LAND TENURE United States Government, Department of Interior, Washington D.C.

PHYSICAL FEATURES The Everglades National Park is a shallow basin tilted to the southwest and underlain by extensive Pleistocene limestones with oolitic and bryozoan facies (the latter largely composed of Schizoporella floridans). The substrate limestone is overlain with variable thicknesses of marl and peat, minimizing water loss downwards. The park serves as a vital recharge area for the Biscayne Aquifer, designated sole source of freshwater supply for Miami and southeast Florida. Lake Okeechobee in the north overflows periodically, inundating two-thirds of the park. Florida Bay has over 20,000,000ha of water with an average depth of 1.5m and a maximum of 3m. It is composed geologically of anastomising mudbanks and unconsolidated calcareous sediments over the limestones. It is one of the most active areas of modern carbonate sedimentation. The park lies at the interface between temperate and subtropical America and between fresh and brackish water, shallow bays and deeper coastal waters thus creating a complex of habitats supporting an immense diversity of flora and fauna. The area of transition from fresh (glade) to saltwater (mangrove) is an incredibly productive zone incubating great numbers of economically valuable crustacea. Temperatures are moderate, rarely freezing in winter, and reaching 23-35°C in summer, with annual precipitation often over 1270mm. Hurricane force storms occur. The Fort Jefferson National Monument consists of a cluster of seven coral reefs called the Dry Tortugas and the surrounding shoals and waters.

VEGETATION The great floral variety of the Everglades was one of the key reasons for the establishment of the park. Among the more prominent and colourful plants are the Bromeliads and epiphytic orchids with some 25 orchid varieties known to occur within the park. There are over 1,000 species of seed-bearing plants, and nearly 120 species of trees, both tropical (palms, gumbo limbo Bursera simarouba and mangroves Rhizophora mangle, Avicennia nitida) and temperate (ash, mulberry and oaks). Even plants ordinarily

associated with the hot and arid deserts, such as cactus, yucca, Agave sp., thrive in certain parts of the park. Over 60 species encountered here are endemic to South Florida. There are five vegetation types: hammocks or tree islands (8,400ha, 1.43%) of mature hardwoods especially mahogany Swietenia mahagoni; mangrove forests (93,150ha, 16.43%) of red mangrove Rhizophora mangle, Laguncularia racemosa and black mangrove Avicennia nitida; pinelands (8,505ha, 1.5%) on elevated limestone outcrops, with an admixture of local slash pine Pinus elliotti var. densa; bayheads (10,125ha, 1.79%) with isolated stands in depressions or on slight elevations of species such as bald cypress Taxodium distichum or the willow Salix caroliniana; and in the north and east, sawgrass prairies and tree savanna (3,240ha, 0.57%) dominated by sedge Cladium jamaicensis. There are also five types of submerged aquatic vegetation, inland freshwater "rivers" (188,325ha, 33%) including flood savannas; small scattered ponds; brackish water marshes; coastal marshes (43,740ha, 7.72%); and the marine sector with turtle grass Thalassia testudinum, shoal grass Diplanthera wrightii and manatee grass Syringodium filiforme dominant. The more notable algae are Caulerpa in deeper water and the family Codiaceae, the latter playing an important role in calcifying the substrate for encrusting by Rhodophyceae and coralline algae. Exotic introductions include the Australian pine Casuarina litorea and wild tamarind Lysiloma latisiliquum.

FAUNA The Everglades protect 400 species of land and water vertebrates (excluding fish) including over 36 threatened species. 25 native mammals occur including the round-tailed muskrat Neofiber alleni struix, Everglades mink Mustela vison evergladensis, Florida panther Felis concolor corgi (E), manatee Trichechus manatus latirostris (V), mangrove fox squirrel Sciurus niger avicennia and the Florida black bear Ursus americanus floridanus. Over 300 bird species, many of limited distribution in the USA, have been recorded, notably the Everglade kite Rostrahamus sociabilis (R), short-tailed hawk Buteo brachyurus, bald eagle Haliaeetus leucocephalus (E), peregrine Falco peregrinus (V), great white heron Ardea occidentalis, reddish egret Dichromanassa rufescens, wood ibis Mycteria americana, roseate spoonbill Platalea ajaja, mangrove cuckoo Coccyzus minor, brown pelican Pelecanus occidentalis, red-cockaded woodpecker Dendrocopos borealis, Cape Sable seaside sparrow Ammospiza maritima mirabilis, Cuban snowy plover Charadrius alexandrinus tenuirostris, ivory-billed woodpecker Campephilus principalis, Florida grasshopper sparrow Ammodramus savannarum floridanus, Rothschild's magnificent frigatebird Fregata magnificens rothschildi, osprey Pandion haliaetus, South-eastern kestrel Falco sparverius paulus, Audubon's caracara Caracara cheriway auduboni, Florida sandhill crane Grus canadensis pratensis, American oystercatcher Haematopus palliatus, roseate tern Sterna dougallii, least tern Sterna albifrons, white-crowned pigeon Columba leucocephala, Florida scrub jay Aphelocoma coerulescens coerulescens and many species typical of the Caribbean region. There are 60 known species of reptiles and amphibians, including the American alligator Alligator mississippiensis, the endangered American crocodile Crocodylus acutus, hawksbill turtle Eretmochelys imbricata, Atlantic green turtle Chelonia mydas mydas and loggerhead turtle Caretta caretta. Twenty-three species of snake have been recorded, including the threatened species the indigo snake Drymarchon corais souperi. The Bahama swallowtail butterfly Papilio ardraemon bonhotei and Schaus swallowtail butterfly P. aristodemus ponceanus are also threatened. Seabirds nesting on the Fort Jefferson National Monument include sooty terns Sterna fuscata, noddy tern Anous stolidus, black noddy tern A. tennirostris found only at Dry Tortugas in the U.S.A., frigatebirds Fregata magnificens and roseate-terns Sterna dongallii. In season a continous procession of songbirds and other migrants fly over or rest on the islands in the Fort Jefferson National Monument.

CULTURAL HERITAGE Fort Jefferson, in the Fort Jefferson National Monument, is the largest of the 19th century American coastal forts. Built between 1846 and 1876, from foundation to crown, the fort's 2.5m thick walls stand 15.2m high. Its three gun tiers were designed for 400 guns and it was large enough to garrison 1,500 men.

ZONING/CONSERVATION MANAGEMENT Strict natural and managed natural zones have been identified. 93% of the park is federally designated as wilderness. A series of designated preservation zones by Metropolitan Dade County protect the park's east boundary from encroaching urbanization. Three separate watershed sources lie outside the park boundaries, but are essential to the integrity of the Everglade system, and are in varying stages of preservation and control: Big Cypress National Preserve on the northwest boundary, 60% Federal property; Shark River Slough watershed in turn supplied by a large number of water conservation areas protected by the State of Florida; and the small privately owned Taylor Slough watershed on which lies the Anhinga Trail, famous for its seasonal wildlife displays. In keeping with the strict tenor of the 1934 Act authorizing Everglades, the development of visitor facilities has progressed according to a concept of preserving the park's essential wilderness qualities and keeping developmental encroachments to a minimum. Currently about 0.1% of the park can be considered developed and as adequate visitor facilities are provided, no expansion is planned. The objective is to complete and refine proposed developments. Controlled burning was pioneered as a management tool at Everglades. Fire has been successfully reintroduced as an essential element in perpetuating a native ecosystem. The fire management plan (1979) and Statement for Management (1977) state current management philosophy.

STAFF Ninety-nine permanent full-time, 45 permanent part-time and 100 seasonal staff

LOCAL ADMINISTRATION General Superintendent, Everglades National Park, PO Box 279, Homestead, Florida 33030.

VISITOR FACILITIES Visitor facilities include visitor centres, nature trails, camping and picnic areas, motel, restaurant, marina (watercraft may only travel along marked and patrolled waterways), small stores, hiking trails and primitive camping areas. Use of the Everglades is devoted to natural-history interpretation, environmental education, and limited wilderness exploration. Camping facilities are available in the Fort Jefferson National Monument.

SCIENTIFIC RESEARCH AND FACILITIES Although there has been extensive documented research on the natural resources of the Everglades, there are still several areas of critical resource management requiring study. A research staff of about 20 scientists and technicians work on hydrology, wildlife and endangered species management, fire ecology, plant ecology, and fisheries. Fort Jefferson National Monument offers excellent research possibilities on coral reef ecology, bird migration, and fisheries. There is an excellent scientific data record for the Dry Tortugas. South Florida Research Centre with study collection and reference library. Modest accommodations are available for scientists in the Fort Jefferson National Monument.

LOCAL POPULATION Most staff members commute from a local community however, 30-50 park personnel and 50-120 concession personnel live in residental areas in the park. A 50ha site along the park's northern boundary is retained by the Miccosukee Indians under a special permit for community development.

MODIFICATION OF THE NATURAL ENVIRONMENT The park is largely undisturbed wilderness. Before its establishment lumbering and farming took place within the present boundaries, but the logged areas have recovered to a near natural state and the farmed areas are being reclaimed through a resource management programme. The disturbed lands and agricultural areas adjacent to the park boundaries have become seed sources for numerous and insidious exotic plant species including water hyacinth Eichhornia crassipes, Casuarina and Schinus, but an ongoing campaign has for the most part controlled the spread of exotics within the park. Walking catfish Clarias batrachus have made some inroads into the park and are being closely monitored. Water management manipulations may be having extensive effects on animal and plant populations, fire behaviour, and the estuarine fisheries and population growth and urban development have affected water quality and wildlife habitats. The park's importance as a wildlife sanctuary depends on the water input into the system and the legal boundaries of the national park do not totally encompass the watershed areas essential for its integrity as a complete system. Increased salinity due to reduced freshwater input may be one factor in the decline in some commercial fish species over the last few years. The input has in the past been shown to be somewhat fragile; during droughts in the early 1960's, water was diverted to the human settlements, resulting in disastrous falls in numbers of animals in the park. Control of the water input does not allow for the natural biological fluctuations that result from the normal hydrological variations. The park immediately adjoins a large metropolitan area so resource management techniques are needed to alleviate pressures caused by urban growth. Other threats include poaching and commercial fishing, and in 1979 outstanding mineral, oil and gas rights still applied to 26,397ha of Federal lands within the park. Over a million visitors a year from 1966-1978, over 850,000 in 1979 and 1980, and over 600,000 in 1981 with decline corresponding to visitation trends in the urban Miami area. Each year about 24,000 students take part in Environmental Education programmes. Peak season is December to April.

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Acknowledgements: The authors wish to thank K.C. Publications for use of certain portions of their book, The Everglades, the Story Behind the Scenery.

Fraser Experimental Forest

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION No information

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION Colorado, on the west side of the Continental Divide. Encompasses the entire headwaters of the main St Louis Creek drainage, a tributary of the Fraser River. The town of Fraser is 8km to the north-east of forest headquarters. 39°54'N, 105°53'W.

ALTITUDE 2,660-3,904m

AREA 9,328ha

LAND TENURE Federal government. Administered by the U.S. Forest Service, USDA.

PHYSICAL FEATURES Base geology is mainly metamorphic rocks - schist and gneiss derived from granite. Sedimentary rocks, though not extensive, include limestone, Dakota sandstone, and Morrison shale. Occasionally an outcrop of volcanic rhyolite occurs. Relief is about 90% dissected, with 10% of the area having slopes 15% or less. Steep, high mountain slopes with evidence of extensive glaciation are the most prominent topographic features. The mean yearly temperature is 0.6°C with a mean temperature for January of -10°C and for July 12.8°C. Mean annual precipitation is about 610mm, two-thirds of which falls as snow.

VEGETATION On the north aspects and at elevations above 2970m are nearly pure stands of virgin Picea engelmannii-Abies lasiocarpa. On the drier sites and at elevations below 2970m are mostly Pinus contorta with a few small scattered stands of Populus tremuloides. Krummholz generally defines timberline at about 3445-3510m. Typical alpine vegetation occupies extensive areas above the timberline. About 260ha of Pinus contorta were burned over, opening up the stand to an understory dominated by Festuca idahoensis.

FAUNA Big game animals, small mammals and birds occur in the Fraser Experimental Forest, but no one species is in great abundance. The big game animals are wapiti Cervus elaphus canadensis, mule deer Odocoileus hemionus and black bear Ursus americanus. Marten Martes americana, weasel Mustela spp., mink Mustela vison, muskrat Ondatra zibethicus, red fox Vulpes vulpes, coyote Canis latrans and bobcat Felis rufus are the small fur-bearing mammals. Three species of trout (Salmo clarkii, Salvelinus fontinalis and Salmo irideus) are found here.

ZONING/CONSERVATION MANAGEMENT The Fraser Experimental Forest is buffered by National Forest on all sides, except for 4km on the north-west boundary.

STAFF One man is assigned to protection and maintenance. A seasonal staff of four to six scientists and four to six technicians are assigned. Research is coordinated with co-operating universities by the Project Leader.

LOCAL ADMINISTRATION Project Leader MFRWU-1251, Rocky Mountain Forest and Range Experiment Staton, 240 West Prospect Street, Fort Collins, Colorado 80521, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The Experimental Forest was established in 1937 to carry out research on timber and watershed management. Since 1965 wildlife management research has been part of the research program. The basic research station was constructed in 1939-40, with additions made in subsequent years. Special management problems that need further investigation include: the integrated effect of timber harvesting on (1) water yield, water quality, nutrient cycling, and sedimentation; (2) game animal and non-game animal habitat requirements including forage production, and (3) windfall, natural regeneration, seed production and growth and yield. The Fraser Experimental Forest is being considered as a candidate for a Biological Research Reserve. It will be permanently maintained as a site for both basic and applied research, education, training and demonstration of land-use management. Since the area is managed for research and demonstration of land-use management problems, it is not intended that it remain in a natural state; however, nearly one-half of the area is essentially in this category and will remain so. The research station has facilities to accommodate about 10-12 people in addition to the permanent staff.

MODIFICATION OF THE NATURAL ENVIRONMENT The valley bottoms were cut-over between 1880 and 1910 for railroad ties. About 500ha were cut and 250ha were subsequently burned over. The stands are now either mixed Picea-Abies-Pinus or second growth Pinus. Timber has been harvested from about 200 ha for research purposes. Timber has been harvested from a 270 ha watershed beginning in 1976. Cattle and sheep have grazed the area for a long time. There is one campground in the Experimental Forest and one adjacent to it. Both are heavily used during the summer. Other recreation uses include hiking - trails are heavily used in the summer - and skimobiling and cross-country skiing during the winter. Access is provided by about 32km of high grade forest roads. About 1 ha is tied up in support facilities.

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Glacier National Park

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION Total

DATE ESTABLISHED 11 May 1910 by Congressional Act (36 Stat. 354). Declared an International Peace Park 30 June 1932 (Presidential Proclamation 2003) in conjunction with the Waterton Lakes National Park in Canada. Accepted as a Biosphere Reserve in June 1976. There are proposals to redesignate the adjacent Glacier and Waterton national parks as an international biosphere reserve.

GEOGRAPHICAL LOCATION Situated in north-western Montana in the northern Rocky Mountains, adjacent to the Canadian border (provinces of British Columbia and Alberta). 48°15'-49°00'N, 113°15'-114°30'W.

ALTITUDE 972-3,185m, with eight peaks over 3,000m, and 32 over 2,800m.

AREA 410,202ha (the Biosphere Reserve occupies the same area). Contiguous to Waterton Lakes National Park (52,597ha) and Flathead Provincial Forest in Canada to the north; Flathead National Forest in the United States on the west and south; the Lewis and Clark National Forest on the south-east; and the Blackfoot Indian Reservation on the east. Both North and Middle Forks of the Flathead River (bordering the park to the west and south) are protected by the Wild Rivers Act, 1968 (amended in 1976).

LAND TENURE Federal government except for 371ha still in private hands (over which the park has jurisdiction, and which are gradually being acquired). Five concessioners currently lease property to provide services for visitors. The park is under the jurisdiction of the National Park Service, U.S. Department of the Interior.

PHYSICAL FEATURES It includes headwaters flowing into three ocean systems, Hudson Bay, the Gulf of Mexico and the Pacific Ocean. Ecosystems range from the extensive boreal forests west of the divide, to the semi-arid foothills of the Rockies in the east, and there are wide variations in elevation and climate throughout which lead to a wide diversity of vegetation types. The northern Rocky Mountains are composed of sedimentary strata of Precambrian age, with major valleys and intervening ridges trending north-east to south-west, and a major thrust (the Lewis Overthrust) of Cretaceous age, bordering the park on the east and emphasizing the contrast between the park and the plains. Five caves (including Haystack, Algal, Zoo and Poia Lake) have been discovered so far, the only Precambrian caves known for Montana. The exposed Proterozoic sedimentary rock layers, coloured by eroded minerals and intrusions of igneous diorite, of some of the cliffs are fine examples of this geological formation. Fossil stromatolites (organo-sedimentary deposits of one of the early blue-green algae lifeforms) are readily observed in several of the park's layered formations. Pleistocene glaciation has resulted in horn-shaped peaks, broad U-shaped valleys, hanging valleys, arêtes, glacial lakes and cirques, as well as 10,936ha of lakes and 2,414km of streams and rivers. The last major glacial retreat was about 10,000 years ago, but some

50-60 small glaciers of more recent origin remain. Mean annual temperatures range from 4°C to 38°C on the west side and 12°C to 36°C on the east side. Mean annual precipitation varies from 480mm to 2500mm according to location, with the rain shadow effect and frequent high winds producing a drier more extreme climate in the east.

VEGETATION The park is the meeting point for several floristic provinces and as such contains examples of several distinctive vegetation types. The west slope boreal forest (46%) chiefly comprises lodgepole pine Pinus contorta-larch Larix occidentalis forest, western red cedar Thuja plicata-western hemlock Tsuga heterophylla forest (at the eastern edge of its continental range), alpine larch Larix lyalli, western white pine Pinus monticola, Douglas fir Pseudotsuga menziesii and grand fir Abies grandis, with Englemann spruce Picea engelmanni and alpine fir Abies lasiocarpa at higher elevations. The northern part of the west slope has remnants of ponderosa pine-bunchgrass associations. The drier eastern slope forests (16.5%) are mainly spruce-fir, and lodgepole pine, with extensive bunchgrass areas and some aspen Populus tremuloides and cottonwood P. trichocarpa at lower elevations. Arctic-alpine communities of the Hudsonian zone occur above 2,100m on the west slope, and 1,800m on the east and comprise tundra (alpine meadows), fellfield (cushion plant communities), and alpine bogs. Krummholz islands at high altitudes result from high winds, ice-shear and short growing season. The principal species in these islands are whitebark pine Pinus albicaulis with some limber pine P. flexilis, alpine fir, alpine larch and Douglas fir. The remaining (3%) are aquatic ecosystems including fens and sphagnum bogs. At low elevations on both slopes riparian communities are dominated by aspen, cottonwood, and willow Salix spp. In all some 1258 vascular plant species have been identified from the park (World Heritage nomination, 1985), including 26 species described as rare within Montana (Lesica, 1984). The rare dwarf alpine poppy Papaver pygmaeum, found on rocky slopes and ridges above the timberline, only occurs in the Waterton-Glacier region.

FAUNA Three species regarded as endangered within the U.S. are found within the park, the wolf Canis lupus (V), the bald eagle Haliaeetus leucocephalus, and the peregrine falcon Falco peregrinus (V). The grizzly bear Ursus arctos horribilus, which is regarded as threatened, has a self-sustaining population of over 200 animals, and there are more than twice as many black bear U. americanus. Both mountain goat Oreamnos americanus and bighorn sheep Ovis canadensis are indigenous. Other noteworthy mammals include lynx Lynx canadensis, mountain lion Felis concolor, river otter Lutra canadensis, wolverine Gulo gulo, least weasel Mustela nivalis, fisher Martes pennanti, hoary marmot Marmota caligata, and northern bog lemming Synaptomys borealis. Some 246 bird species have been recorded, of which the following are of additional interest to those already described above, western grebe Aechmorphus occidentalis, American bittern Botaurus lentiginosus, Swainson's hawk Buteo swainsoni, long-billed curlew Numenius americanus, hairy woodpecker Picoides villosus, willow flycatcher Empidonax traillii, and loggerhead shrike Lanius ludovicianus. Indigenous fish include westslope cutthroat salmon Salmo clarki (one of the last strongholds for native populations), Kokanee salmon Onchorhynchus nerka (its spawning run attracts the bald eagle to the area), bulltrout Salvelinus confluentus, lake whitefish Coregonus commersoni and arctic grayling Thymallus arcticus. Both brook trout Salvelinus fontinalis and rainbow trout Salmo gairdneri have been introduced.

CULTURAL HERITAGE There are a number of known prehistoric sites, some dating back to 1000BC, and the area has been used (or passed through) by peoples of the Blackfeet, Kootenai, Kalispel, Flathead, and possibly Assiniboine tribes.

Numerous historic structures ranging from homestead cabins to early park buildings remain, and are due for listing in the National Register of Historic Places. The 80km Going-to-the-Sun highway, built between 1921 and 1933, is an impressive monument to early road engineering, and is listed as a National Historic Road.

ZONING/CONSERVATION MANAGEMENT Over 92% of the area is proposed for wilderness management, with the remaining area proposed as managed natural areas. No visitation is allowed in certain sensitive areas, and use of much of the park is monitored and regulated. Development is discouraged, and confined to the road corridors. Glacier National Park is one of the most intensively managed parks in North America. A master plan and various statements and guidelines for management are in force.

STAFF In 1984, there were 58 permanent full-time, 40 part-time and 350 seasonal employees.

LOCAL ADMINISTRATION Superintendent, Glacier National Park, West Glacier, Montana 59936.

VISITOR FACILITIES 2.2 million people visited the park in 1983, some 20% from outside the U.S. There are 320km of roads, and 1181km of foot and horseback trails cross the area. Accomodation is available in a number of hotels, cabins and camp grounds. There is a visitor centre and interpretation programmes were begun in the park as early as 1929.

SCIENTIFIC RESEARCH AND FACILITIES Research within the park varies widely, and has been increased in emphasis with the designation of the park as a biosphere reserve. The aim of many of the projects is to establish criteria for conservation, management, or restoration of natural ecosystems, and threatened species. Current studies by park ecologists and others include gray wolf ecology, ecology of mountain goats and wintering ungulates, ecology of grizzly bear and the influence of people on behaviour and ecology, forest succession following mountain pine beetle Dendronotus ponderosae infestation and wildfire, aquatic ecosystems, genetics, population and distribution of west slope cut-throat trout, impact of Kokanee salmon and man on the chemistry and bacteriology of McDonald Creek, population dynamics of the pine marten Martes americana, local and long-range movements of bald eagles, the effect on woodpecker (Picidae) populations of mountain pine beetle infestations, fisheries, snow algae, geology, benthic invertebrates, high elevation entomology, larvae of stonefly genera, glaciology, impact of fire on recreation, glacier snowmelt, and trauma in victims attacked by grizzly bear. There are no special indoor facilities for research, but a research laboratory is planned for the research office building. There is a research library, and an expanding database which is used as a tool in the protection and management of natural resources, and which is closely linked with a number of the monitoring programs currently being conducted in the park. The Glacier Institute offers college-level summer courses.

MODIFICATION OF THE NATURAL ENVIRONMENT Gaseous and particulate fluorides from a nearby aluminium reduction plant exceeded emission standards from 1955 until 1980 when new equipment was introduced; monitoring continues. Logging, and gas and mineral exploration near park boundaries, will have adverse impacts on the integrity of the wilderness ecosystems. A proposed open pit coal mine (Cabin Creek Coal Mine Project) in south-east British Columbia, 14km from the park boundary, threatens aquatic resources and air quality. The matter is under arbitration by the International Joint Commission, the body responsible under the the U.S./Canada Boundary Waters Treaty, and should be

resolved by late 1986 (World Heritage nomination, 1985). Logging in British Columbia is reaching the north boundary, and is now causing stream siltation. Other increasing land developments adjacent to park boundaries are bringing growing numbers of visitors and users who are affecting the behaviour of the grizzly bear by their presence. There are some conflicts with alternative management approaches in the adjacent Blackfoot Reservation and on the Provincial Forest land, but these are highly localised and restricted to the immediate boundary areas. Lesser problems include the spread of introduced plant species which are competing with the native vegetation in places (methods for their control are being investigated) and the suppression of the natural fire regime for the last 75 years, which is now recognised as having been detrimental to the sustained health of the ecosystem (revised management programmes are being considered). The federal State of the Parks report to Congress in 1980 rated Glacier as the most seriously threatened park in the United States.

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Great Smoky Mountains National Park

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern Forest)

LEGAL PROTECTION Total. No removal of natural resources permitted except for certain fish excluding brook trout.

DATE ESTABLISHED 22 May 1926 as a National Park (44 Stat. 616) and June 1976 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Southern end of the Appalachian Mountains in eastern Tennessee and western North Carolina, bounded by the Little Tennessee River in the south, the French Broad River to the north and the Pigeon River in the east. Surrounded by parts of several National Forests, an Indian reservation, and a Tennessee Valley Authority lake. Gatlinburg (Tennessee) lies close to the north entrance and Cherokee (North Carolina) the south entrance. 35°26'-47'N, 83°45'-84°00'W.

ALTITUDE 259-2,025m

AREA The biosphere reserve covers an area of 209,000ha. The park comprises about 25% of the total area protected in the Eastern Forest biogeographic province.

LAND TENURE Federal government

PHYSICAL FEATURES The dominant topographic feature of the park is the range of the Great Smoky Mountains with 16 peaks over 1,818m. The park is surrounded by several national forests, an Indian reservation, a Tennessee Valley Authority (TVA) lake and numerous private holdings. Lesser ridges form radiating spurs from the central ridgeline. In broad aspect, the topography of the park consists of moderately sharp-crested, steep-sided ridges separated by deep V-shaped valleys. Many of the mountain ridges branch and subdivide creating a complex of drainage systems with many fast-flowing clear mountain streams. The park contains 22 major watersheds and the water table is near the surface in almost all sections. Precambrian metamorphic rocks consisting of gneisses and schists, and sedimentary rocks of the Precambrian OCOEE series are predominant, while sedimentary rocks in the Appalachian Valley are the youngest. Mean annual temperature for Gatlinburg is 13.7°C, but the average temperature is 5-10° cooler higher up, with warm humid summers and relatively mild winters. Precipitation averages 1625mm annually, but differences in average annual precipitation of more than 600mm have been recorded between a peak and valley only 15km apart. Snow accumulations may reach 1.2m at 1,500m, but are negligible below 1,000m.

VEGETATION The area is a Pleistocene refuge and thus an outstanding example of the diverse Arcto-Tertiary geoflora era, having a high number of temperate species (1,400 species of flowering plants and 2,200 others including 130 trees) with some rich mixed stands. Some 30% of the park is virgin forest and areas previously logged have been recovering for varied periods of time presenting a range of successional stages. Deciduous broad-leaved and needle-leaved evergreen conifer forests predominate with smaller areas of treeless grass and heath balds, open wet meadows and cliffs. The vegetation changes continuously with elevation, slope aspect and soil moisture patterns, notable types being: cove hardwood and hemlock forests dominated by 25-30 diverse tree species including Liriodendron tulipifera, Halesia carolina var. monticola, Tilia heterophylla, Quercus rubra, Fraxinus americana, Acer saccharum, Betula lutea, and Tsuga canadensis, six-12 species being co-dominant at any one site, with diverse herbaceous understoreys with vernal peak flowering; a one-tenth hectare plot may support 40-50 species through the year. Forest areas include northern hardwood forest Fagus grandifolia, B. lutea, Acer saccharum, Aesculus octandra; spruce-fir forest of Picea rubens, Abies fraseri, B. lutea, Sorbus americana (the block of virgin red spruce is the largest left on earth, and over 40% of southern Appalachian spruce-fir occurs in the park); mixed oak forest of Quercus alba, Q. rubra,

Q. prinus and formerly Castanea dentata; and pine-oak forest of Pinus rigida, P. pungens, P. virginiana, Quercus coccinea, Nyssa sylvatica and Oxydendrum arboreum. On mesic sites, cove forest grades with elevation into northern hardwoods and finally spruce-fir forest, the transition occuring at ca. 1,700m. At mid and lower elevations, along a gradient from mesic to xeric sites, cove forest is replaced by mixed oak and then by pine-oak. Heath balds represent the xeric extreme at higher elevations and evergreen broadleaved shrubs dominate including Rhododendron minus, R. catawbiense, Kalmia latifolia, Leiophyllum buxifolium. Grass balds, cliffs, landslide scars and upper elevation forests support the growth of rare southern Appalachian endemics. Five species are officially listed as endangered on the Fish and Wildlife Service List of Candidate Endangered Plants (Federal Register 45: 82480, 1980): Smoky Mountains manna grass Glyceria nubigena, spreading avens Geum radiatum, Cain's reedgrass Calamagrostis cainii, mountain rush Juncus trifidus var. Monathos and Rugel's ragwort Cacelia rugelia, but an additional 120 threatened species occur. This park represents the southern most range of the red spruce and many other northern species.

FAUNA A diverse fauna occurs includes at least 50 native animals, reflecting the richness of the flora. With the exception of the black bear Ursus americanus and white-tailed deer Odocoileus virginianus, large mammals are seldom seen though red fox Vulpes fulva, gray fox Urocyon cinereoargenteus, racoon Procyon lotor, opossum Didelphis marsupialis, woodchuck Marmota monax and bobcat Lynx rufus range throughout the park. Other mammals include the red squirrel Tamiasciurus hudsonicus, grey squirrel Sciurus carolinensis, muskrat Ondatra zibethicus, cottontail rabbit Sylvilagus floridanus, several species of mice, moles and shrews, long-tailed weasel Mustela frenata, mink M. vison, and skunks. Several species of bats inhabit the park. The threatened Indiana bat Myotis sodalis (V) is known to use at least one of the park's caves as a winter roost. There have been several recent, but unconfirmed, sightings of mountain lions Felis concolor. Beaver Castor canadensis, apparently once common here, are reappearing in several valleys. Bison Bison bison, wapiti Cervus elaphus, timber wolf Canis lupus (V), fisher Martes pennanti and otter Lutra canadensis once occurred here and could possibly be reintroduced. Over 200 species of birds have been observed with over 60 permanent residents including robin Turdus migratorius, cardinal Cardinalis cardinalis, song sparrow Melospiza melodia and wild turkey Meleagris gallopavo, and some 100 species have been observed in the park and immediate vicinity during the winter. The peregrine falcon Falco peregrinus (V) once nested, but this species is rarely seen here now; the red-cockaded woodpecker Picoides borealis (V) has also been observed nesting, but the population is sparse and the species seldom seen. Reptile species include seven turtle, eight lizard and 23 snake. Heavy precipitation and numerous streams make the mountains ideal for a wide variety of amphibian species including about 27 salamander (the red-cheeked salamander Plethodon jordani appears to be endemic to the park), two toads and at least ten frogs. Over 70 species of native fish inhabit the streams including the eastern brook trout Salvelinus fontinalis (the park's population may be a separate and threatened subspecies). Other theatened fish species reported include the smoky madtom Noturus baileyi, yellow-fin madtom N. flavipinnis (V) and stonecat N. flavus (though some of these may no longer exist in park waters). Over 20 minnow species and several kinds of darter, sucker, sunfish, bass, bullhead and catfish are also found. The park also contains a diversity of invertebrates, especially land snails, spiders, insects and other arthropods, that is not well known. 105 species of stonefly including endemics such as Magaloptera williams, Hansonoterla appalachia, several Capnia spp. and Acroneura lycorias (found only in Sevier County). Most groups reveal a complex assortment of forms that often include species endemic to the park and/or new to science.

CULTURAL HERITAGE Archaeological sites support the theory that prehistoric people (15,000 years ago) were hunters and gatherers. Present historical and cultural interpretation in the park is based mainly on the structures dating from the middle 1800's to 1920 including the finest collection of log buildings in the U.S.A. The National Register of Historic Places includes three historic districts, eight structures and 28 buildings.

ZONING/CONSERVATION MANAGEMENT Natural zone 92%; Historic zone 1%; Development zone 7%. A limited area contains visitor, maintenance and administrative facilities and the park also contains the historic district of Cades Cove. The remaining area has been allowed to revert to a forest state through natural plant succession processes and much management effort is directed at keeping human impact to a minimum. The park has a general management plan and a series of sectoral management plans.

STAFF 105 permanent and 200 temporary and full-time employees

LOCAL ADMINISTRATION Superintendent, Great Smoky Mountains National Park, Gatlinburg, Tennessee 37738.

VISITOR FACILITIES The park attracts about 680,000 visitors each year. Camping grounds, trailer parks, hotels and other infrastructure are now encouraged outside the park. Facilities within the park include nine campgrounds (three primitive), two visitor centres and 18 shelters along the Appalachian Trail and other back country trails (668km).

SCIENTIFIC RESEARCH AND FACILITIES Research funded by the NPS is mainly directed at monitoring impacts and developing methods for reducing, eliminating, or compensating for them. Much effort is being made to conduct and coordinate research under the guidance of scientists based at the Uplands Field Research Laboratory. Research projects include the dynamics of exotic wild boar population; influence of certain exotic plants; the influence of the balsam woody aphid; the impacts of hiking, horseback riding and camping on park ecosystems; the dynamics of the park's native brook trout populations as it relates to human activities, and the effects of two exotic species of trout. The laboratory maintains comprehensive monitoring programmes on a variety of chemical pollutants and biological communities. Uplands Field Research Laboratory offering both research and accomodation facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Several road systems pass through the park as well as over 1,280km of horse and foot trails which dissect the high country. The 3 historical zones have open fields of grass and Cades Cove supports a cattle operation. Subsistence farming and commercial logging have been practised in the past, and logging railroads were built. Some of the 1,200 structures in the park when it was established have been removed, destroyed or allowed to deteriorate. Exotic species of plant and animal in particular wild boar Sus scrofa and two trout species are a disturbance and are removed regularily. Other threats include plant pests such as balsam woolly aphid, air pollution and visitor impact.

PRINCIPAL REFERENCE MATERIAL

The park library and Uplands laboratory have numerous reference documents, and there are about 600 publications relating to the park. A full bibliography of scientific study has been published by the Southern Appalachian Research/ Resources Management Cooperative and Western Carolina University (1982, US MAB Report No. 4, Washington DC) who also published a history of scientific study in the area (1982, US MAB Report No. 5, Washington, DC).

Campbell, C.C. (undated). Birth of a National park in the Great Smoky Mountains.

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H.J. Andrews Experimental Forest

BIOGEOGRAPHICAL PROVINCE 1.20.12 (Sierra-Cascade)

LEGAL PROTECTION Laws applicable to National Forest lands plus special designation as research property under Forest Service Regulation U4. Dedicated exclusively to research and education.

DATE ESTABLISHED Accepted as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION On western slopes of Cascade Range in the state of Oregon. Entire drainage of Lookout Creek. The city of Eugene, Oregon, is 65km to the west. 44°15'N, 122°10'W.

ALTITUDE 435-1,631m

AREA 6,100ha

LAND TENURE Federally owned

PHYSICAL FEATURES Mature mountainous topography with moderate to steep slopes. Miocene-Pliocene extrusives (andesite, basalt and other pyroclastic rocks). Mild, wet winter, dry summer climate; annual precipitation 2390mm at lower elevations, with increasing total precipitation and winter snowpack (up to 3m or more) with elevation.

VEGETATION Dense virgin coniferous forests and associated stream systems (to fifth order) are key biological features. Two main vegetation zones: a Tsuga heterophylla zone to about 1,200m with Pseudotsuga menziesii, Tsuga heterophylla and Thuja plicata as dominants; and a lower montane zone with Abies amabilis, A. procera, Pseudotsuga, Tsuga mertensiana and T. heterophylla as dominants. Two main age classes of forest: 450 and 130 years old. Very high biomass in both age classes (800-1000 tons/ha is common).

FAUNA Native fauna intact except for wolf Canis lupus which is now extinct in the region. Northern spotted owl Strix occidentalis and harlequin duck Histrionicus histrionicus are notable rare species found here.

ZONING/CONSERVATION MANAGEMENT Zoned for various types of research including approximately 25% in permanent control sites. In addition, approximately another 4,000ha of Research Natural Areas serve as satellite control areas.

STAFF Manpower allocated to site totals around 30 man-years, but most are not exclusively assigned to it.

LOCAL ADMINISTRATION U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Most intensively studied area in this type of forest. Long-term studies of effects of forest cutting on water quality and quantity and on regeneration and growth of young forests has been underway since 1948. Intensive carbon, water, and nutrient cycling studies since 1968. Current emphasis is on: structure and function of forest ecosystems along successional (time) and environmental gradients; structure and function of stream ecosystems along size gradient; effects of stresses on carbon, water, and nutrient cycles; forest canopy subsystems; and geomorphic processes and erosion. Substantial research facilities present, good access.

MODIFICATION OF THE NATURAL ENVIRONMENT Approximately 20% of the area has been subject to logging and 100km of road constructed as part of research and experimentation on silvicultural practices and environmental effects of cutting. Minor recreational use. Minor hunting; no fishing allowed, but non-native rainbow trout were introduced prior to closure.

PRINCIPAL REFERENCE MATERIAL

Dyrness, C.T. (1967). Mass soil movements in the H.J. Andrews Experimental Forest. U.S. Department of Agriculture Forest Service Research paper PNW-42. U.S. Department of Agriculture Forest Service, Pacific Northwest Forest and Range Experimental Station, Portland, Oregon.

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Fredriksen, R.L. (1970). Erosion and sedimentation following road construction and timber harvest on unstable soils in three western Oregon watersheds. U.S. Dep. Agric. For. Serv. Res. Pap. PNW-104. U.S. Dep. Agric. For. Serv. Pac. Northwest For. and Range Exp. St., Portland, OR.

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Swanson, F.J. and James, M.E. (1975). Geology and geomorphology of the H.J. Andrews Experimental Forest, Western Cascades, Oregon. U.S. Dep. Agric. For. Serv. Res. Pap. PNW-188. U.S. Dep. Agric. For. Serv. Pac. Northwest For. and Range Exp. St., Portland, OR.

U.S. Army Corps of Engineers, North Pacific Division (1956). Snow hydrology: summary report of the snow investigations. U.S. Army Corps of Engineers, Portland, OR.

U.S. Forest Service, Region 6 (1964). Soil survey report of the H.J. Andrews Experimental Forest, Willamette National Forest. U.S. Forest Service, Region 6, Division of Watershed Management, Portland, OR.

Hubbard Brook Experimental Forest

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern forest)

LEGAL PROTECTION Total since 1955

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Near West Thornton, New Hampshire in the White Mountain National Forest. Area name derived from major drainage in the valley, Hubbard Brook. Stream flows generally west to east, emptying into Pemigewasset River. The Atlantic Ocean is 116km to the southeast. 43°56'N, 71°45'W.

ALTITUDE 229-1,015m

AREA The Biosphere Reserve covers an area of 3,076ha

LAND TENURE Owned by the U.S. Government. About 95% of surrounding area (all forested) also owned by U.S. Government and administered by White Mountain National Forest since 1920.

PHYSICAL FEATURES The metamorphosed bedrock in the western half of the area is Kinsman quartz monzonite. The eastern half is Littleton sillimanite zone gneiss. Prime feature of the bedrock is its impermeability. There is no evidence of significant faulting, and visible fissures appear to diminish in size rapidly with increasing depth. Virtually all precipitation must leave the watershed via evapotranspiration or as streamflow. Soils are predominantly well-drained sandy loam haplorthods of the Berkshire series that are relatively infertile and derived primarily from coarse glacial till. Average slope 20-30%. Stream length of main Hubbard Brook within the area is 11.5km. About 16 tributary streams enter Hubbard Brook. Mirror Lake, an uncontrolled 14.9ha oligotrophic lake, lies immediately east of the Experimental Forest. Climate is classified as humid continental with short, cool summers. Mean air temperature in July is 19°C, and -9°C in January. Mean annual precipitation is 1,300mm, of which about one-third to a quarter falls as snow. The precipitation is distributed equally among the months of the year. A continuous snowpack develops each winter to a depth of about 1.5m. Soils remain largely unfrozen in winter.

VEGETATION The area is entirely forested with uneven-aged, well stocked, northern hardwoods, primarily sugar maple *Acer saccharum*, American beech *Fagus grandifolia* and yellow birch *Betula alleghaniensis*. On the ridges, rock outcrops, and along the main Hubbard Brook, conifers such as red spruce *Picea rubens*, balsam fir *Abies balsamea* and hemlock *Tsuga canadensis* predominate. About 100 species of shrubs and herbs are present.

FAUNA Most of the common fauna associated with northern hardwood forests are found. Major mammals are snowshoe hare *Lepus americanus*, beaver *Castor canadensis*, red fox *Vulpes fulva*, black bear *Ursus americanus*, bobcat *Lynx rufus*, and white-tailed deer *Odocoileus virginianus*.

ZONING/CONSERVATION MANAGEMENT See Land Tenure above

STAFF Staff of four permanent scientists

LOCAL ADMINISTRATION Project Leader, Northeastern Forest Experiment Station, PO Box 640, Durham, New Hampshire 03824, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES During the last 21 years the Forest Service has established eight stationary stream-gauging stations and a network of 21 precipitation-climatological stations on an experimental watershed ranging in size from about 12ha to 76ha. Since 1963 cooperative research programs have involved personnel from Yale University, Cornell University, Dartmouth College, University of New Hampshire, University of Massachusetts, several other educational institutions, Federal and State agencies, and private organizations. A wide variety of research studies have been and are being conducted in the forest, including such fields as soils, ecology, meteorology, hydrology, forestry, geology, plant physiology, limnology, mammalogy, ornithology, pathology, entomology. Most of these have involved in one way or another the cycling of water, energy, and nutrients through the forest ecosystem. A main gravel road of about 10km and spur roads of 6km to the stream-gauging stations, all below the experimental watersheds, provide access to the forest. A field laboratory building is open year-round with 4 offices (60 sq.m), conference room (50 sq.m), laboratory (27 sq.m) and dormitory (8 people).

MODIFICATION OF THE NATURAL ENVIRONMENT With the exception of about 64ha that have undergone experimental treatment in the last 11 years, the area has not been disturbed since selective logging occurred between 1910-1919. Hunting, fishing and hiking are presently permitted but camping and use of all-terrain vehicles are discouraged.

PRINCIPAL REFERENCE MATERIAL

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Pierce, R.S., Hornbeck, J.W., Likens, G.E., and Bormann, F.H. (1970). Effects of elimination of vegetation on stream water quantity and quality. In: International Symposium on results of research on representative and experimental basins. Int. Assn. Sci. Hydrol., Wellington, New Zealand.

Jornada Experimental Range

BIOGEOGRAPHICAL PROVINCE 1.09.07 (Chihuahuan)

LEGAL PROTECTION No information

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION On the Jornada del Muerto Plain in New Mexico, which is bounded by the San Andres Mountains on the east and by the Rio Grande Valley and a mountain complex on the west. 32°37'N, 106°45'W.

ALTITUDE 1,260-2,830m

AREA The Biosphere Reserve covers an area of 78,297ha.

LAND TENURE United States Government

PHYSICAL FEATURES The Jornada Experimental Range extends from the crest of the San Andres Mountains out onto the Jornada Plains. The San Andres Mountains are a west-dipping fault block composed mainly of Paleozoic marine sediments, but also including sandstones, shales and gypsum beds. A broad, coalescent fan-piedmont lies at the mountain base and gradually merges with a level to gently undulating basin floor with scattered playas. The Jornada plain consists of unconsolidated Pleistocene detritus contributed by the ancestral Rio Grande River. The soils are low in humus and high in lime and caliche is often present at variable depths. Average daily extremes of temperature are -6°C and 13°C in January and 13°C and 35°C in June. Average annual precipitation is 230mm with a single maximum in late summer. Severe droughts are frequent.

VEGETATION The San Andres Mountains contain shrub woodlands dominated by Juniperus monosperma and Pinus cembroides and a large number of shrub types where Acacia constricta, Fouquiera splendens, Dasylirion wheeleri, Cercocarpus montanus and Larrea tridentata are common dominants. The Jornada plain is a semidesert grassland with Bouteloua eriopoda, Sporobolus flexuosus and Aristida longiseta as principal dominants. Vast areas of the plain have been invaded by shrubs, principally Larrea tridentata, Flourensia cernua and Prosopis juliflora. Extensive duning has occurred on sandy areas invaded by P. juliflora. Some 545 high plant species are found. Details are given in Paulsen and Ares (1962) and Buffington and Herbel (1965).

FAUNA The native fauna is intact and includes a relatively large (200 individuals) herd of Ovis canadensis mexicana. Odocoileus hemionus are abundant in foothills and mountains and a small herd (50 individuals) of Antilocapra americana persist on the plains. Rodent populations are varied and large, and lagomorphs are cyclically abundant. A few of the introduced Oryx beisa have taken up residence in the plains.

ZONING/CONSERVATION MANAGEMENT The Jornada Experimental Range is buffered on the north and east by US Military lands with restricted access and on the west and south by the New Mexico State University Experimental Ranch and other government lands. The Jornada headquarters is located in the centre of the area with three families in residence. A portion of the area lies within the San Andres National Wildlife Refuge. Managed for research on production and grazing of livestock by the Agricultural Research Service, US Department of Agriculture.

STAFF Staff of five research scientists and seven technicians

LOCAL ADMINISTRATION Location Leader, Jornada Experimental Range, PO Box 698, Las Cruces, New Mexico 88001, U.S.A.

VISITOR FACILITIES No tourist facilities exist. Public use is largely confined to three-day special hunts held once yearly.

SCIENTIFIC RESEARCH AND FACILITIES The Jornada Experimental Range has been the site of research activity since 1914. Unbroken climatic records extend from this date, as do vegetation and grazing use records. Detailed studies have been many and varied. This was one of the Grassland Biome study sites under the International Biological Program (IBP). Recently accelerated research efforts are directed at: (1) defining the structure and function of

range ecosystems, and determining the morphological, physiological, and abiotic factors that govern establishment, growth, reproduction, and persistence of range plants; (2) developing range improvement practices for revegetating disturbed and deteriorated rangelands, stabilizing soils, improving water management and controlling pests to increase productivity of range ecosystems; and (3) developing improved grazing strategies to convert range forage to animal products consistent with conservation and multiple use of range ecosystems. On-site research facilities and equipment are available and the site is readily accessible from Las Cruces, N.M. (30km) where New Mexico State University provides additional research facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT No tourist facilities exist and public use is largely confined to three-day special hunts held once yearly. For the past 60 years the area has been impacted only by moderate grazing and a limited amount of brush control work. Approximately 600ha have had livestock excluded for 40 to 60 years and 16,900ha have not been grazed for 24 years.

PRINCIPAL REFERENCE MATERIAL

Buffington, L.C. and Herbel, C.H. (1965). Vegetation changes on a semidesert grassland range. Ecological Monographs 35: 139-164.

Paulsen, H.A. Jr. and Ares, F.N. (1962). Grazing values and management of black grama and tobosa grasslands and associated shrub ranges of the Southwest. U.S. Dept. Agr., Forest Serv. Tech. Bull. 1270. 56pp.

Luquillo Experimental Forest (Caribbean National Forest)

BIOGEOGRAPHICAL PROVINCE 8.40.13 (Greater Antillean)

LEGAL PROTECTION No information

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Located within the Luquillo Mountains of eastern Puerto Rico, approximately 35km east of San Juan. 18°21'N, 65°45'W.

ALTITUDE 150-1,080m

AREA The biosphere reserve covers an area of 11,340ha

LAND TENURE Publicly owned (federal) area. Private inholdings total 50ha

PHYSICAL FEATURES The topography is mountainous and six major river systems begin in the mountains. Waterfalls and cascades are common. Soils are generally acid clays, and four soil series (Los Guineos, Rough Stoney Land, Yunque, and Guayabota) comprise 70% of the area. Often these soils are shallow and/or stony and are not suitable for cultivation. Above 600m, soils are frequently saturated. The climate is warm and wet. On foothills and slopes below 600m, annual precipitation is 1750-2500mm, mean annual temperature is above 25°C. On peaks and high ridges above 800m, annual precipitation exceeds 3700mm and temperature averages 19°C. Weather data are available in Briscoe (1966).

VEGETATION Four vegetation types are generally recognized. On the lower elevations, the lower montane rainforest (Beard, 1944) or the subtropical wet

forest (Holdridge, 1947; Ewel and Whitmore, 1973) is found. This is the most diverse forest; it contains three strata, and the emergent stratum is up to 35m tall. Shrubs and herbs are unimportant. Dacryodes excelsa is the dominant tree; Sloanea berteriana and Manilkara bidentata are other prominent species. The montane thicket or the subtropical rainforest is found in the valleys and gentle slopes above 600m elevation. This type has two strata and a canopy layer less than 15m high; colorado Cyrilla racemiflora is the dominant tree. The palm brake (Beard), characterised by Sierra palm Euterpe globosa, is associated with unstable soils. The elfin woodland or dwarf forest is a unique forest at the highest elevations. The tree canopy varies from 6m in height to less than 1m on the most exposed peaks. Trees are festooned with mosses and epiphytes. Details of biotic and abiotic environment are available in Wadsworth (1951).

FAUNA The diversity of birds within the forest is relatively low; a checklist of breeding birds prepared for the National Forest contains only 35 species. The Puerto Rican parrot Amazona vittata (E) is the only parrot native to U.S. territory still in existence. Fewer than 25 parrots remain in the wild, and all are found in the Caribbean National Forest. An intensive research and management effort is underway to save the species. Bats are the most common and conspicuous mammal. Other mammals found within the forest are the introduced Indian mongoose Herpestes spp., the black rat Rattus rattus, the wharf rat R. norvegicus and feral cats Felis catus. The Puerta Rican boa Epicrates inornatus (E) has not been well studied and little is known of its habitat requirements, distribution, and life history.

ZONING/CONSERVATION MANAGEMENT Within the forest, 2,800ha are designated for timber management, 2,330ha designated as research tracts. Special areas include the Bano de Oro Research Natural Area, a 745ha tract of virgin rain forest representing the major forest types in which only non-destructive research activities are allowed and long-term protection is the goal. The core area includes a "Research Natural Area" devoted to non-destructive research. The buffer zone includes areas devoted to timber management and recreation. The area is managed by the United States Forest Service (USFS) as both a National Forest Reserve and Experimental Forest. The forest represents the largest tract of contiguous ownership on the island. It contains the largest remnant of undisturbed forest vegetation of several forest types and is protected from hunting and from large scale habitat disturbance.

STAFF ITF research staff, seven scientists and ten support personnel

LOCAL ADMINISTRATION Director, Institute of Tropical Forestry, PO Box AQ, Rio Piedras, Puerto Rico 00928.

SCIENTIFIC RESEARCH AND FACILITIES The USFS has conducted research within the forest since 1932, with many of the published results appearing in the Caribbean Forester. Other significant research includes the Atomic Energy Commission (now ERDA) and the Nuclear Centre of the University of Puerto Rico programme of ecological research begun in 1963 and including the El Verde radiobiology project (reported by Odum and Pigeon, 1970). A modified programme continues with emphasis on hydrological research. Research in the dwarf forest was conducted by the Arnold Arboretum of Harvard University (e.g., Howard, 1968). At the Institute of Tropical Foirestry (ITF) a new program of research in the natural forest was begun in 1975. Proposed research includes studies of productivity, stand development, impacts of timber harvest on residual stands and recovery of stands following harvest, and ecological life histories of tree species. The El Verde Field Station provides a permanent base with easy access for research in the Luquillo

Mountains. Both laboratory and housing are available. Laboratory and office space, a nursery and workshop are available at ITF headquarters in Rio Piedras, one hour from the forest. Scientists and students from both the US and Latin America (Spanish language) are welcome.

MODIFICATION OF THE NATURAL ENVIRONMENT The core of the National Forest represents original Spanish Crown land and was never inhabited. The Natural Area is within this zone and thus serves as an undisturbed baseline community. The fringe areas of the forest were subjected to farming or timber removal. Following purchase, these areas were planted and silviculture is now being practised. Recreation is a major activity within the forest, but almost all of the estimated 1,000,000 visits recorded were in the road corridors and in a single 15ha picnic area.

PRINCIPAL REFERENCE MATERIAL

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Noatak Biosphere Preserve

BIOGEOGRAPHICAL PROVINCE 1.13.09 (Alaskan tundra)

LEGAL PROTECTION The Noatak Biosphere Reserve was nominated under the Alaska National Interest Lands Conservation Act (ANILCA) in 1980.

DATE ESTABLISHED Established on 1 December 1978 as a National Preserve. Approved in June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In north-western Alaska about 770km west and north of Fairbanks; entirely north of the Arctic Circle and bounded on the west by coastal hills of the Chukchi Sea, on the north by Petroleum Reserve No. 4 and on the east by the proposed gates of the Arctic National Park. 68°N, 160°W.

ALTITUDE 30-1,679m

AREA The Biosphere Reserve covers an area of 3,035,200ha. (In November 1984 the Biosphere Reserve boundary was expanded to include the upper Noatak River watershed in the Gates of the Arctic National Park increases the areaq of the park from 2,655,870ha to its present day value).

LAND TENURE Federally owned except for native allotments (total 1,726ha)

PHYSICAL FEATURES The region contains a variety of physiographic features including glacial moraines, cirque valleys, interior plateaux, coastal beaches and estuaries, the rugged Brooks Range and vast river valleys. The Noatak winds through the entire area and is the longest protected wild river.

VEGETATION The Noatak Valley is situated at the merge of arctic and subarctic vegetational formations. The Noatak River closely follows the timberline zone. Immediately south of the river lies the continuous spruce forest of the taiga biome. The tundra of the Alaskan arctic slope abuts the northern edge of the basin. Most of the Noatak Basin supports a rather typical low arctic tundra, however boreal forest covers much of the lower Noatak Valley and a number of transitional formations occur throughout the length of the valley. Vegetation types in the area are: forest including high evergreen spruce, moderately high mixed evergreen and deciduous, upland spruce, lowland and river bottom spruce and cottonwood forests; brushland of high brush and low brush muskeg with riparian willow thickets, willow parkland-tundra, tundra willow thickets and transitional brushland/tundra; tundra including moist tundra, wet tundra and coastal marsh with tussock and shrub/tussock and alpine mesic tundras; fell-field and alpine vegetation comprising barren and sparse dry tundra; and aquatic vegetation comprising coastal marshes, emergent lacustrine and submerged lacustrine vegetation.

FAUNA This includes 17 species of mammal in 14 families. Nearly one third comprise taiga species which rarely range beyond the northern limit of spruce. Others are confined primarily to the tundra and the remainder range within both biomes. Species include grizzly and black bear Ursus arctos and U. americanus, barren ground caribou Rangifer arcticus, Dall sheep Ovis dalli dalli, moose Alces alces, grey wolf Canis lupus, coyote C. latrans, red fox Vulpes fulva, lynx Lynx canadensis, wolverine Gulo gulo, arctic hare Lepus othus and brown lemming Lemmus trimuc ronatus. About 66% of the migratory Arctic caribou herd (at least 240,000) passes through the Noatak Valley twice each year. Bird life is especially varied in summer and most species are migratory. About 122 species of 31 families have been identified including 16 bird of prey species and 31 additional species are expected to occur. Up to 25 species of waterfowl including whistling swan Cygnus columbianus and four species of loons may inhabit Noatak's varied wetland habitats. The Noatak and Squirrel river drainages provide habitats for about 22 species of arctic fish including the anadromous and landlocked populations of arctic char Gavia spp. A major run of char is known to occur annually in the Noatak River and principal tributary, the Kelly. All five species of Pacific salmon may be present.

CULTURAL HERITAGE It is a region of special archaeological and palaeontological significance which may yield information on the earliest human settlements in North American and on the palaeontology of the Bering Sea Land Bridge.

ZONING/CONSERVATION MANAGEMENT The statement for management includes Natural Zone (95%), Park Development Zone (1%) and Special Use Zone which contains native allotment lands and mining claims. The reserve is open to sports hunting but mining, mineral exploration, logging and dam building are ordinarily forbidden. The development of visitor facilities and roads is kept to a minimum.

STAFF Three permanent full-time (superintendent, chief ranger and administrative technician) and six seasonal employees. All personnel are shared with Kobuk Valley NP and Cape Krusenstern NM.

LOCAL ADMINISTRATION Superintendent, Noatak Biosphere Reserve, General Delivery, Kotzebue, Alaska 99752.

VISITOR FACILITIES Visitor facilities are available

SCIENTIFIC RESEARCH AND FACILITIES Ongoing and intermittent research on subsistence lifestyles. Research on reindeer/caribou competition, fire ecology and fisheries. There area no facilities for scientists in the park.

LOCAL POPULATION The population of the region is predominantly Inupiat Eskimo concentrated at Kotzebue with a population of 1,965. Kotzebue is linked by daily jet air service to Fairbanks, Nome and Anchorage. The economic life of the region continues to be dominated by subsistence use of natural resources although the impact of a cash and wage economy is gaining momentum.

MODIFICATION OF THE NATURAL ENVIRONMENT The area is basically untouched by modern man. Some sports hunting occurs but primary use is by Alaskan natives in pursuit of their subsistence way of life.

PRINCIPAL REFERENCE MATERIAL

Numerous references in the National Park Service Library, Alaska Regional Office in Anchorage, University of Alaska Library in Fairbanks and Preserve Office in Kotzebue.

The Alaska Planning Group (1974). Final Environmental Impact Statement, Proposed Noatak National Arctic Range. US Department of the Interior.

Olympic National Park

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION Complete protection under Act of Congress of 29 June 1938. Fishing is permitted.

DATE ESTABLISHED 29 June 1938 as a National Park; the Pacific Coastal Area and Queets River Corridor were added 6 January 1953. Accepted as a Biosphere Reserve in June 1976, and a World Heritage Site in 1981.

GEOGRAPHICAL LOCATION In the northwestern corner of the United States bordering on Canada, on Olympic Peninsula, Washington state. 47°29'-48°11'N, 123°07'-124°42'W.

ALTITUDE 0-2,428m

AREA The Biosphere Reserve consists of 363,379ha in two units: 344,046ha including the Olympic Mountains and 19,333ha in the Pacific Coastal Area. National Park and World Heritage Site: 362,848.7ha.

LAND TENURE 99.6% Federal Government; 0.4% privately owned

PHYSICAL FEATURES The park is divided into two segments: a mountainous core and a separate coastal strip. The rugged features of Olympic National Park are the result of the collision of drifting continental plates. When normal subduction processes, associated with continental drift, moved further westward out to sea, an upwelling of submarine sediments and volcanic material followed. A dome 95km in diameter was created consisting of contorted beds of

shale, slate and sandstone with interspersed lavas. The Olympic Mountains are the highest in this coastal range bounding the Pacific ocean, and are the central topographic feature of the park. They are of sedimentary in origin and range from late Tertiary to Quaternary age. The action of 11 major rivers and many glaciers (60 of which remain) has carved the dome into a vast array of deep canyons and jagged peaks. Ancient 1,000m thick continental ice sheets transported non-native granite up to 200km from British Columbia, Canada. 4,300 ha of ice, luxuriant rain forests with 100m tall trees, and 90km of rugged wave-battered coastline combine to create a park of great physical and biological diversity. Climate is moderate and temperatures rarely drop below -7°C or rise above 27°C. Mean annual temperatures are 10°C at lower elevations with a yearly range from 1°C to 17°C. Storms account for 4,000mm of precipitation annually in western rain forest valleys and 5,000mm on Mount Olympus; only 53km to the northeast precipitation falls to 300mm, creating the greatest precipitation gradient per distance in the world at a temperate latitude.

VEGETATION The five major vegetation zones are: 1) Sitka spruce zone (36,284ha, 10%), containing temperate rain forest and characterized by Sitka spruce Picea sitchensis, western hemlock Tsuga heterophylla, western red cedar Thuja plicata, and bigleaf maple Acer macrophyllum along the coast and in valley bottoms. 2) Lowland forest zone (36,284ha, 10%), characterized by western hemlock Tsuga heterophylla, western red cedar Thuja plicata, grand fir Abies grandis and Douglas fir Pseudotsuga menziesii, an extensive fire sub-climax species up to 550m elevation. 3) Montane zone (181,425ha, 50%), characterized by western hemlock Tsuga heterophylla in lower and drier habitats, Pacific silver fir Abies amabilis in higher and more moist habitats and Douglas fir Pseudotsuga menziesii as an extensive sub-climax in eastern portions of the park (generally from 550-1,100m). 4) Subalpine zone (72,570ha, 20%), characterized by mountain hemlock Tsuga mertensiana in the western portion of the park and subalpine fir Abies lasiocarpa in the eastern portion, including extensive park-like meadows (generally from 1,100m to around 1,600m). 5) Alpine/glaciers region (36,284ha, 10%), characterized by red mountain heather Phyllodoce empetriformis, tall sedge Carex spectabilis, spreading phlox Phlox diffusa and large tracts of snow and ice (highest ridge and mountain tops). The park contains 500 taxa of vascular plants, of which at least 13 are endemic. The endemic Olympic flora includes six species; Cotton's milk-vetch Astraglaus cottonii, Piper's bellflower Campanula piperi, Olympic mountain daisy Erigeron flettii, rockmat Petrophytum hendersonii, Olympic butterweed Senecio neowebsteri and Flett's violet Viola flettii; and seven varieties: Piper's bellflower white form Campanula piperi v. soveregniana, magenta paintbrush Castilleja parviflora v. olympica, wallflower Erysimum arenicola v. arenicola, white coiled-beak lousewort Pedicularis bracteosa v. astrosanguinea, kittentails Synthris pinnatifida v. lanuginosa and Olympic rockcress Arabis furcata v. olympica.

FAUNA 180 species of birds and 50 species of mammals, with at least seven endemic taxa. The native fauna is intact except for the local subspecies of wolf Canis lupus nubilus, which was extirpated by man before the park was established. The large coastal subspecies of elk Cervus elaphus roosevelti was first described in the Olympic Mountains and its protection was an important reason for establishing the park, with an estimated 3000-5000 animals in the area. The Rocky Mountain goat Oreamnos americanus was introduced by man before the park was created and is now fully established with an estimated population of 500-1000. The endemic Olympic fauna includes three species: Olympic marmot Marmota olympus, Beardslee trout Salmo gairdneri beardsleei and Crescenti trout Salmo clarkii crescentis, and four subspecies: Olympic mole Scapanus townsendi olympicus, short-tailed weasel

Mustela erminea olympicus, Olympic chipmunk Tamias amoenus caurinus and Olympic mazama pocket gopher Thomomys mazama melanopes. Other noteworthy species are cougar Felis concolor, coyote Canus latrans, mule deer Odocoileus hemionus ssp columbianus, fisher Martes pennanti, snowshoe hare Lepus americanus subsp. washingtonii, peregrine falcon Falco peregrinus (V) and spotted owl Strix occidentalis. Over 50 species of smaller animals have been identified. Nearly 1,000km of streams and rivers in the park are inhabited by some 20 native fish species, including seven species of salmon and trout that migrate to and from the ocean.

CULTURAL HERITAGE A few abandoned homestead clearings (0.5 to 5ha) are evident in certain lowland valleys, and several are designated as historical sites.

ZONING/CONSERVATION MANAGEMENT 96% of the park is managed as a wilderness area and 4%, including all public facilities, is managed as a natural area. There are various management plans for the area. In April 1981 a goat control programme began, aimed at removing 180 goats and expanding a goat-free alpine zone.

STAFF Seventy-eight permanent, 28 permanent part-time and 107 seasonal employees

LOCAL ADMINISTRATION Superintendent, Olympic National Park, 600 E. Park Avenue, Port Angeles, Washington 98362

VISITOR FACILITIES Nine ranger stations and nine seasonal tourist facilities are located around the periphery of the park.

SCIENTIFIC RESEARCH AND FACILITIES Since 1971 management studies by the park staff have extensively investigated human recreational impact and its mitigation in back-country camping areas. Other management problems needing research attention include baseline surveys of all major biotic subsystems, terrestrial and aquatic, as benchmarks for sound management strategy; the ecological role and appropriate management of wildfire, population ecology and protection of Cervus elaphus roosevelti and its role as consumer in forest communities; status and protective measures needed for native genetic stocks of anadromous fish species; and status and protection of alpine plant endemics with increasing recreational use. Distinctive plant communities have been described by Fonda and Bliss 1969, Kuramoto and Bliss 1970, and Fonda 1974. Research has suggested that the goats have reduced plant cover, increased erosion and shifted plant community dominants toward more resistant or less palatable species, and they have been recorded feeding on at least three of the endemic plant species. There is a 5,000-specimen study collection and reference library.

POPULATION Towns on the peninsula are small (Port Angeles has 16,500 inhabitants) but less than 80km to the east the Seattle-Tacona urban complex has a population of nearly two million.

MODIFICATION OF THE NATURAL ENVIRONMENT The core of the Olympic Mountains is still largely undisturbed mountain and forest. No timber harvesting is permitted in the park but there is some illegal felling, rapidly increasing around the boundaries. Introduced mountain goats Oreamnos americanus have had an impact on high elevation communities. 0.4% of the park, which is privately owned, is visually obtrusive. A proposed oil superport and related refineries to be located in Port Angeles harbour, 4.6km from the park could have an adverse effect on the park. Water quality in coastal areas is also threatened

by large-scale applications of herbicides in timber-producing areas adjacent to the park. No timber harvesting occurs in the park but is rapidly increasing around its boundaries. Tourists and other visitors have an adverse effect on the park. Over 2.5 million people visit the park annually but most stay near 267km of the road that enters the mountain valleys peripherally and skirts about 25% of the Pacific Ocean coastline. 1,000km of trails interconnect the mountainous interior for foot and horse passage. There are at least 125,000 overnight hikers each year, many along the ocean coastline.

PRINCIPAL REFERENCE MATERIAL Numerous publications are available in the park library, Pioneer Memorial Visitor Centre, Port Angeles.

Fonda, R.W. (1974). Forest succession in relation to river terrace development in Olympic National Park, Washington Ecology 55(5): 927-942.

Fonda, R.W. and Bliss, L.C. (1969). Forest vegetation of the montane and subalpine zones, Olympic Mountains, Washington. Ecological Monographs 39: 271-301.

Hutchins, M. and Stevens, M. (1981). Olympic Mountain Goats. Natural History January.

Kuramoto, R.T. and Bliss, L.C. (1970). Ecology of subalpine meadows in the Olympic Mountains, Washington. Ecological Monographs 40: 317-347.

Tabor, R.W. (1975). Guide to the geology of Olympic National Park. University of Washington Press, Seattle.

Organ Pipe Cactus National Monument

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION Total

DATE ESTABLISHED 13 April 1937 as a National Monument; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION South-western Arizona, south boundary shared with Mexico; 32°00'N, 112°50'W.

ALTITUDE 335-1,472m

AREA Biosphere Reserve 133,278ha; National Monument 133,671ha

LAND TENURE Federal government

PHYSICAL FEATURES The topography is characterized by short northerly trending fault block mountain ranges separated by wide flat alluvial basins. The geological strata vary from Precambrian, Cardigan gneiss, to present alluvial fill. Volcanic activity during the middle and late Tertiary period resulted in the forming of two series of volcanic rock (andesitic tuffs and breccias, and lava flows). The valleys of this portion of the Sonoran Desert experience temperature ranges from 0°C to 42°C. Precipitation occurs during the brief monsoon rains of late summer and as cyclonic rains of midwinter, providing an annual rainfall of 240mm.

VEGETATION Predominantly desert scrub. Three major associations of the Sonoran desert are represented here. Listed in decreasing order of land area occupied by each, these are: Arizona upland represented by saguaro cactus Cereus giganteus, palo verde Cercidium spp., mesquite trees, organ pipe

cactus, prickly pear cactus, chain fruit Agave spp. and teddybear cholla; California microphyll phase of the Sonoran desert represented by creosote bush Larrea tridentata and bursage Ambrosia spp.; and floristic components normally associated with the Mexican Gulf coast association including the elephant tree Bursera microphylla and senita cactus Cereus thurberi. Of lesser importance by size, but also represented here, are desert riparian and a relict oak woodland type. A total of 522 taxa of flowering plants are represented in the monument. Many of the plant species present are not well represented elsewhere in the United States. For example Lemaireocereus thurberi, Lophocerus chotti, Sapium biloculare, Bursera microphylla and Atamisquea emarginata. Quercus ajoensis and Neolloydia erectocentra var. acunensis are two rare species found here.

FAUNA Fory-eight native mammals occur within the monument, including the endangered Sonoran pronghorn Antilocapra americana sonoriensis. Forty-three reptiles and five amphibians are recorded and over 250 bird species have been documented. One native fish occurs here, the rare desert pupfish Cyprinodon macularius.

CULTURAL HERITAGE The area also has a rich human history from the Spanish explorers of the 15th century to bandits and ranchers of the 19th century. There are several small historic sites on the reserve.

ZONING/CONSERVATION MANAGEMENT 95% of the land is designated and managed as wilderness.

STAFF There are 13 full-time, permanent employees

LOCAL ADMINISTRATION Superintendent, Organ Pipe Cactus National Monument, P.O. Box 38 Ajo, Arizona 85321.

VISITOR FACILITIES A 208-site campground is located near the south central portion along with a visitor centre/maintenance facility.

SCIENTIFIC RESEARCH AND FACILITIES Organ Pipe Cactus National Monument is a member of Unesco's Man and the Biosphere Program and in this capacity is promoting efforts to collect baseline data about the resources of the area. Numerous studies have been conducted by independent investigators and with university collaboration. A bibliography of all conducted research has been compiled. Plant references collection (herbarium), reptile, amphibian and insect collections, library and audio/visual equipment are available. Monthly rainfall data is collected from ten disjunct locations; an official weather station collects temperature and wind speed and direction data. A NADP (National Atmospheric Deposition) station and a high volume, coarse particulate sampler are in operation. Dormitory housing is available for researchers. At present a research facility is being developed to provide workspace and collections housing for use by visiting research scientists and university groups.

LOCAL POPULATION Two ranches and several ranch employees comprise the total non-federal resident human populations.

MODIFICATION OF THE NATURAL ENVIRONMENT The entire area, with the exception of the upper reaches of the mountains, has been modified by past cattle grazing. This activity is though to have originated in 1699 and continued until 1978, when the remaining livestock were removed. The extent of modification is mostly unquantified but has resulted in visible soil erosion and some floral species composition changes. Contemporary ranches and mines are present, as well as one privately owned inholding of 63ha.

PRINCIPAL REFERENCE MATERIAL There is a wildlife observation card file dating back to the 1940's. A soil survey report, vegetation map and survey of the vascular flora of Organ Pipe Cactus National Monument have been completed. Numerous other studies relating to local flora and fauna are kept at the park.

Cox, T.J. (1966). A behavioural and ecological study of the desert pupfish (Cyprinodon macularius) in Quitobaquito Springs, Organ Pipe Cactus National Monument, Arizona. PhD thesis, University of Arizona, Tucson.

Hensley, M.M. (1954). Ecological relations of the breeding bird population of the desert biome in Arizona. Ecological Monographs: 24(2): 185-207.

Mulroy, T.W. (1971). Perennial vegetation associated with the organpipe cactus in Organ Pipe Cactus National Monument, Arizona. M.Sc. thesis, University of Arizona, Tucson.

Rocky Mountain National Park

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION Total

DATE ESTABLISHED 26 January 1915 as a National Park; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION Front Range of Rocky Mountains along the Continental Divide; headwaters of the Colorado River on the West Slope, and drained by the Big Thompson River on the East Slope, approximately 65 miles north-west of Denver, Colorado. 40°10'-40°33'N, 105°29'-105°55'W.

ALTITUDE 2,328-4,345m

AREA The Biosphere Reserve covers an area of 106,710ha. The National Park covers an area of 107,519ha.

LAND TENURE Federal government

PHYSICAL FEATURES The Rocky Mountains were formed by a series of granitic batholiths intruded into Precambrian micaschists and pegmatities. Volcanic activity has more recently altered parts of the west side. The physiography of the East Slope is characterized by steep cliffs and U-shaped valleys, as altered by local Pleistocene glaciation. Lateral moraines running east and west characterize lower elevations. The generally more level, rolling alpine tundra areas were apparently not glaciated and fall away less steeply to the Upper Colorado River valley on the west side. The climate is typically montane, with low precipitation, about 400mm falling on the east side and about 500mm falling on the west side. Average temperatures are moderate, with a 24°C annual average on the east and 19°C annual average on the west.

VEGETATION Three vegetation zones are present. The upper montane forest (from 2,328m to about 2,743m elevation) is characterized by the Ponderosa pine Pinus ponderosa shrub vegetation type, usually with an open canopy and a well-developed understorey. In the lower elevations, larger open areas of grassland types and meadow types exist. From approximately 2,743m to 3,505m, the subalpine forest zone is characterized by the Engelmann spruce Picea engelmanni, subalpine fir Abies lasiocarpa and limber pine Pinus flexilis, with a rather sparse understorey. Openings in the forest canopy are common and vegetated with a large variety of grasses and forbs. The alpine tundra

exists above 3,500m elevation. It is characterized by open stands of grasses and sedges and many dwarf flowering plants and willows.

FAUNA Early meat hunting and sport hunting drastically reduced ungulate populations. Cervus elaphus were reintroduced in 1913-14 and have since increased to a herd of about 1,500. Odocoileus hemionus are now common and about 50 Ovis canadensis utilize the high-elevation ranges. Some species, however, such as Ursus arctos, Canis lupus, Lutra canadensis, Antilocapra americana and Bison bison never recovered. Canis latrans and Ursus americana survived early pressures and are currently common. Castor canadensis also recovered and they dominate most of the watercourses. Other mammals found in the park include the yellow bellied marmot Marmota flaviventris, pika Ochotona alpina and coyote Canis latrans. There are over 150 species of birds in the park including bald eagle Haliaeetus leucocephalus, white-tailed ptarmigan Lagapus leucurus, Steller's jay Cyanolitta stelleri and dipper Cinclus mexicanus. The native trout on the east side, Salmo clarkii stomias, has been restored to a few drainages, but most of the lakes and streams are dominated by exotics. The remainder of the native fauna, typical of the central Rocky Mountains, is mostly intact.

ZONING/CONSERVATION MANAGEMENT There are four zones and six related subzones identified in the park:- Natural Zone: Wilderness Recommendation subzone 97,060ha, Outstanding Natural Feature subzones (tundra) 35,613ha, Natural Environment subzone (below treeline) 60,208ha, Research Natural Area subzone 9,308ha, Historic Zone 573ha, Development Zone 311ha, Special use Zone: Private Development subzone 909ha, Resource Utilization subzone 159ha. The Wilderness Recommendation subzone contains 91% of the total park area. Therefore, sections of the other zones are contained within this subzone.

STAFF The staff consists of 51 permanent full-time, 33 permanent part-time and 200 seasonal employees.

LOCAL ADMINISTRATION Superintendent, Rocky Mountain National Park, Estes Park, Colorado 80517.

VISITOR FACILITIES The visitor facilities in the reserve include a number of campsites, visitor centres, interpretive trails and environmental study areas.

SCIENTIFIC RESEARCH AND FACILITIES Three Research Natural Areas have been designated in which no overnight or livestock use is permitted by the public. Major studies have been conducted or are in progress on the geology; alpine tundra ecology; Cervus elaphus ecology; range use and population dynamics; Lagopus leucurus ecology and life history; Colorado tick fever; forest composition and dynamics; Ovis canadensis ecology; natural fire ecology; and visitors impact. Further research is needed for management on the greenback trout, predator-prey relationships, plant succession, beaver ecology, black bear populations, elk and bighorn sheep relationships. A study collection of 10,000 specimens, a research library and natural research study areas exist.

MODIFICATION OF THE NATURAL ENVIRONMENT Outside of developed areas and roadways, the impact of modern man has been minimal. Four water storage compounds are still in use, with several others abandoned. Former homestead sites in the lower meadow areas are modified by past agricultural practices, and many exotic plant species exist. Many of the streams and lakes are inhabited by exotic species of sport fish. There are over 2.8 million visitors, most of whom use only the developed areas. About 58,000 camper days were recorded in the back-country in 1980.

PRINCIPAL REFERENCE MATERIAL

Approximately 180 works of reference have been published.

Armstrong, D.N. (1976). Rocky Mountain Mammals. Rocky Mountain Nature Association, Inc.

Nelson, R.A. (1970). Plants of Rocky Mountain National Park. Rocky Mountain Nature Association, Inc.

Richmond, G.M. (1974). Raising the roof of the Rockies. Rocky Mountain Nature Association, Inc.

San Dimas Experimental Forest

BIOGEOGRAPHICAL PROVINCE 1.07.06. (Californian)

LEGAL PROTECTION Set aside by order of the Chief of the Forest Service on 28 March 1934, under Reg. L-20 of the regulations of the Secretary of Agriculture relating to the occupancy, use, protection and administration of the National Forests. From 31 January 1938 the Experimental Forest was closed to public access by order of the Chief of the Forest Service based on Clause (c), paragraph (1) of Regulation T-9.

DATE ESTABLISHED Approved as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Access directions from Ontario airport: 32km west to Glendora Hq., Glendora, California. Experimental Forest is about 10km north-east of Headquarters. Also about 80km north-east of Los Angeles International Airport. 34°12'N, 117°46'W.

ALTITUDE 381-1,615m

AREA 6,947ha

LAND TENURE Central government owns nearly 100% of the area but about 4% of the area within the forest has been in recreational home tracts since the formation of the Experimental Forest. These areas excluded as home tracts are consolidated in one site.

PHYSICAL FEATURES The Experimental Forest includes two watersheds that are in the San Gabriel Mountain foothills and drain into the Los Angeles, California Basin and the Pacific Ocean via the San Gabriel River. The experimental area within the San Gabriel Mountain fault block is typically very steep and extensively dissected by steep walled canyons. The average slope angle is 68°C. Rocks are of complex origin and include predominantly metamorphic or granitic formations but sedimentary and igneous formations exist. Soils are typically young, coarse textured, rocky and shallow (average depth less than 0.91m). The soils are near neutral in pH and of low fertility. Because of the highly dissected nature, the two major watersheds fully within the boundaries of the Experimental Forest (Dalton, 1,155ha and San Dimas, 4,079ha) can be subdivided into numerous small to intermediate sized watersheds. Flood control dams control all stream flow from the major watersheds and small debris dams have been built and are maintained on four of the small watersheds. Average annual precipitation at the Experimental Forest headquarters is 678mm, 95% of which falls in the period from October through April. Open pan evaporation is 1626mm, and average temperature is 14.4°C with a range from -3.6°C average minimum to 38.8°C average maximum.

VEGETATION The vegetation consists of the following plant communities: 1)Chamise chaparral (Adenostoma fasciculatum dominant), 3,300ha; 2) scrub oak chaparral (Quercus dumosa dominant), 1,300ha; 3) mixed chaparral (Adenostoma fasciculatum, Quercus dumosa, Ceanothus spp., Cerocarpus betuloides codominant), 500ha; 4) riparian woodland (Alnus rhombifolia, Acer macrophyllum, Umbellularia californica, Quercus spp. codominant), 700ha; 5) Sage-buckwheat and barren areas (Salvia spp., Briogonum fasciculatum codominant), 400ha; 6) oak woodland (Quercus agrifolia or Q. chrysolepis dominant), 400ha; 7) big cone Douglas fir (Pseudotsuga macrocarpa), 300ha; 8) open yellow pine (Pinus ponderosa), 40ha.

FAUNA A good representation of all the common native southern California fauna are found in the Experimental Forest. The following is a partial list of the fauna. Mammals: San Diego wood rat Neotoma fuscipes macrotis, brush rabbit Sylvilagus bachmani, California mule deer Odocoileus hemionus californicus, California racoon Procyon lotor psora, California gray fox Vulpes cinereoargenteus californicus, California wildcat Lynx rufus californicus, Anthony gray squirrel Sciurus griseus anthonyi, Gambel white-footed mouse Peromyscus maniculatus gambelii, California valley coyote Canis latrans ochropus, California mountain lion Felis concolor californica. Birds: horned owl Bubo virginianus pacificus, mourning dove Zenaida macroura marginella, California quail Lophortyx californica californica, Cooper's hawk Accipiter cooperii, golden eagle Aquila chrysaetos canadensis, red-tailed hawk Buteo jamaicensis calurus, American kestrel Falco sparverius. Waterfowl (migrants found on flood control reservoirs): mallard Anas platyrhynchos platyrhynchos, canvas-back Aythya valisneria, goosander Mergus merganser americanus, green-winged teal Anas crecca. Reptiles: Pacific coast newt Triturus torosus, San Diego alligator lizard Gerrhonotus multicarinatus webbii, California striped racer Coluber lateralis, California garter snake Thamnophis hammondii, Pacific rattlesnake Crotalus viridis oreganus, Southern Pacific terrapin Clenmys marmorata pallida, California boa Lichanura roseofusca roseofusca.

ZONING/CONSERVATION MANAGEMENT The Experimental Forest is divided into two major watersheds. Big Dalton watershed is 1,155ha and San Dimas watershed is 4,079ha. The remaining 1,713ha drain into watersheds not entirely within the boundary of the Forest. One small 555ha watershed in the San Dimas watershed has been designated the Fern Canyon Research Natural Area and about 200ha of the San Dimas watershed have been designated a Roadless Study Area. Major study areas designated for possible modification of chaparral are limited to about 300ha in the San Dimas watershed and to two 350ha subwatersheds in Big Dalton Watershed.

STAFF National Forest Services provides protection and maintenance. No staff are currently assigned full time to the Experimental Forest. One staff member is assigned part-time to research coordination among Forest Service Research and unversity researchers.

LOCAL ADMINISTRATION Project Leader, San Dimas Experimental Forest, 110 North Wabash Ave, Glendora, CA 91740, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Historic: Numerous hydrologically related studies have been carried out on the Experimental Forest. These hydrologic studies have established 1) soil-water-plant standards for chaparral and related ecosystems, 2) erosion hazard potential related to fire and chaparral modification in chaparral, 3) water yield from natural and modified chaparral

watersheds, and 4) rainfall distribution related to topographic features. Some studies have also been done on chaparral phenology and post-fire secondary succession. Potential for current and future research: During the last four years cooperative work has increased to include researchers in seven local universities. MAB is partially funding some of the studies but a major reason for the interest in cooperative work is the opportunity provided by the Experimental Forest. There have been no studies that have involved coordinated multidisciplinary systems analysis. Management of chaparral and related ecosystems in southern California must consider: the impact of fire which can typically be expected to occur once every 25-35 years on any given area; erosion hazard that is typically severe following wildfire; intensive human impact resulting in air pollution; demand for maximum water yield; and demand for extensive recreational opportunities. Currently little is known about chaparral fauna. Little is known about microbiology, soil-plant nutrient budget, chaparral and chaparral woodland physiology, or site biotic potential. Although chaparral and related ecosystems including riparian and other woodland communities have been described, little physiological ecology work has been done. The use of periodic prescribed fire in chaparral has been advocated but neither the technique nor the impacts of prescribed fire have been worked out. A densely populated air pollution-prone area such as southern California presents unique problems. The San Dimas Experimental Forest is a relatively natural biological unit provided with the most complete hydrologically monitored background of any chaparral ecosystem in California. Some watersheds have been monitored for 40 years beginning 17 years after a fire in 1919 and continuing up to the present. A laboratory building in the Experimental Forest is available and though currently not being used is in good repair and could be modified for use. Living quarters are available for short stays during winter and spring by special arrangement.

MODIFICATION OF THE NATURAL ENVIRONMENT Manipulation of the vegetation cover has been done experimentally in portions of the 1,000ha areas described above under zoning. Some additional modification has occurred in the recreational homesite areas in lower San Dimas Canyon. Two flood control reservoirs are present at the border of the Experimental Forest in Big Dalton and San Dimas Canyon. Finally, several basin catchments for trapping and measuring sediment, debris, and stream flow are present at the mouth of the small study watershed. In late November 1975, approximately 1620ha were burned in a wildfire. The remainder of the Experimental Forest was burned in 1960. Vegetation community numbers four, six and seven and eight were partly burned in one or both fires and are in the process of recovering.

PRINCIPAL REFERENCE MATERIAL

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San Joaquin Experimental Range

BIOGEOGRAPHICAL PROVINCE 1.07.06 (Californian)

LEGAL PROTECTION Complete protection from domestic herbivores of 24ha research natural area; livestock grazing is permitted on the remaining 1,808ha as specified by range-wildlife environmental research investigations.

DATE ESTABLISHED Accepted as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION In the foothills on the western slopes of the central Sierra Nevada mountains. The town of Fresno, California lies approximately 40km south of the entrance to the reserve. 37°05'N, 119°43'W.

ALTITUDE 213-518m

AREA The Biosphere Reserve covers an area of 1,832ha

LAND TENURE Entirely U.S., Government public land surrounded by private lands.

PHYSICAL FEATURES The geological strata of the Sierra mountains were formed towards the end of the Jurassic period. Granitic rock outcrops are common on the rolling hills of the Biosphere Reserve. Soils are of granitic origin, generally less than 750mm deep, and were classified as Ahwahnee or Visalia series. Annual precipitation averages 483mm with the range from 257mm to over 82mm. Precipitation, principally in the form of rainfall, occurs mainly during the months of October through to May. Monthly mean air temperatures range from 5.6°C in January to over 26.7°C in July. Extremes in monthly average temperature range from slightly above 0°C on January to almost 38°C in July.

VEGETATION The flora consists of two phytocoenoses; the California steppe and the lower elevation of the California woodlands (Küchler, 1970). Throughout the ecosystem, annual plants are the dominant life form even where aspect dominance is maintained by open woodlands. Scattered trees and occasional dense patches of brush are interspersed throughout the annual plant range type. The most numerous trees are Quercus douglasii, Q. wislizenii and Pinus sabiniana. Common shrubs are Ceanothus cuneatus, Rhus diversiloba and Arctostaphylos mariposa. The herbaceous understory consists of approximately 400 introduced annual species, the most common being Erodium botrys, Bromus mollis, Festuca megalura, Avena barbata, Bromus rigidus and Bromus rubens. Remaining understory herbaceous vegetation consists primarily of a mixture of Lotus spp., Trifolium spp., Lupinus spp., Hordeum spp., Juncus spp., Bromus spp., and Phacelia spp..

FAUNA The vertebrate fauna is characteristic of the Upper Sonoran life zone. A checklist of vertebrate fauna reported seven fish, eight amphibians, 19 reptiles, 38 mammals, and 149 bird species (Newman and Duncan, 1973). The Californian quail Lophortyx c. californica is the most abundant avian resident. The Californian ground squirrel Spermophilus beecheyi fisheri and Botta's pocket gopher Thomys bottae mewa are the most abundant mammals, although resident migratory herd of Odocoileus hemionus are common.

ZONING/CONSERVATION MANAGEMENT The entire 1,832ha serves as the biosphere reserve without subdividing for zones or buffer strips.

STAFF There is a staff of approximately 15 assigned for protection, maintenance, and research investigation; the Superintendent coordinates all management activities.

LOCAL ADMINISTRATION Superintendent, Pacific Southwest Forest & Range Experiment Station, 1130 "o" St., Rm 2003, Fresno, CA 93721, U.S.A.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES In 1934 the U.S. Forest Service established the San Joaquin Experimental Range to investigate resource and animal husbandry problems associated with maintaining a commercial cattle herd on a year-round basis on the foothill rangelands. Objectives of early animal husbandry research on the Range are summarized by Hutchinson and Kotok (1942). Since the early 1940's, major research efforts have included measurements of annual forage production, methods of improving this production, and beef cattle investigations. Zoological studies on the Experimental Range have dealt chiefly with life histories of rodents, their impacts on range forage, food habits and management of quail, and food habits of predators. Investigations on the Experimental Range have resulted in more than 250 publications (Sanderson and Duncan, 1966). Because of on-going research, this area will serve as an oak woodland-annual plant ecosystem productivity model. The area could also serve as benchmarks to determine the long-term grazing effects on threatened and endangered plant and animal species. The effects of long-term grazing and habitat manipulation on density and distribution of game and non-game wildlife species should also be investigated. There is not information available on the research facilities available in the biosphere reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Range Unit 80 (24ha) has served as a research natural area, protected from fire and ungrazed by domestic livestock since 1934. Remaining portions of the Experimental Range have been grazed, more or less at a moderate rate, since early 1930's by various classes of livestock and seasons. Some Range Units have been modified through the application of various fertilizers. Prescribed burning has also been used on some range units for forage improvement.

PRINCIPAL REFERENCE MATERIAL

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Sequoia and Kings Canyon National Park

BIOGEOGRAPHICAL PROVINCE 1.20.12 (Sierra-Cascade)

LEGAL PROTECTION Complete protection. The area is administered for recreational use with fishing and pack and saddle stock use permitted.

DATE ESTABLISHED General Grant National Park 25 September 1890, incorporated into Kings Canyon National Park 1940; Sequoia National Park 25 September 1890. Accepted as a Biosphere Reserve in June 1976.

GEOGRAPHICAL LOCATION In southern Sierra Nevada, California. Dissected by the Kern, Kaweah and Kings River drainages, the parks are located between the

San Josquim Valley to the west and the Ownes Valley to the east. The town of Three Rivers is adjacent to the southwest entrance. 36°45'N, 118°30'W.

ALTITUDE 336-4,418m, including the highest point in the contiguous United States.

AREA Biosphere Reserve: total 343,000ha, including Kings Canyon: 186,295ha (186,115ha Federal, 181ha other); Sequoia: 163,125ha (162,507ha Federal, 618ha other);

LAND TENURE Exclusive Federal jurisdiction over all lands within the park boundaries, except for proprietary jurisdiction in the Mineral King area.

PHYSICAL FEATURES From west to east, the parks extend from the foothills of the San Joaquin Valley to the crest of the Sierra Nevada and contain the highest and most scenic parts of that range. The Sierra Nevada batholith was slowly uplifted throughout the Miocene, then abruptly so in the late Pliocene. It is the largest fault block range in the United States. The eastern edge is a steep escarpment, as much as 3,049m vertical. The western slopes grade gently to the Central Valley of California. Pleistocene glaciers left an abrupt topography of granite carved canyons and domes. Hundreds of glacial lakes are present. Five life zones are represented, from Upper Sonoran desert to alpine areas above the tree line. Average daily temperature extremes at Ash Mountain (518m) are 0.5°C and 8.3°C in January and 20.5°C and 36.6°C in August. Average annual precipitation ranges from 660mm to about 1120mm. Wet winters (December-April) and dry summers (June-October) are characteristic.

VEGETATION A diverse flora, including some 120 families and 2,175 species, subspecies and varieties are listed by Rockwell and Stocking (1969). The most notable vegetation is the forests of giant sequoia Sequoiadendron giganteum, including the largest living tree, "General Sherman", which is 83.8m in height and 31.3m in diameter at the ground. Oak woodland with Quercus douglasii, Q. wislizenii and chaparral with Adenostoma fasciculatum, Arctostaphylos viscida characterize the lower elevations. Mixed conifer forest with Colorado white fir Abies concolor, red fir A. magnifica, western yellow pine Pinus ponderosa, sugar pine P. lambertiana and lodgepole pine P. contorta forests and montane meadows occupy the middle elevations, while subalpine forests with foxtail pine P. balfouriana, P. albicaulis and meadows, krummholz, and alpine ecosystems typify the higher elevations.

FAUNA A rich fauna includes 73 species of mammals, 194 birds, 22 reptiles, and ten amphibians. The native fauna is intact except for grizzly bear Ursus horribilis and wolf Canis lupus, the former eliminated prior to 1924. The most commonly seen animals include chipmunk Tamias spp., yellow-bellied marmot Marmota flaviventris, California ground squirrel Spermophilus beecheyi, black bear Ursus americanus and mule deer Odocoileus hemionus. Resident but rarely seen are martens Martes americana, fishers M. pennanti and wolverines Gulo gulo, these last being species of remote primitive areas. Also rarely seen are bighorn sheep Ovis canadensis californiana, a threatened species of restricted range. The nearly extinct Gymnogyps californianus and the rare Strix occidentalis range within the parks.

ZONING/CONSERVATION MANAGEMENT 291,500ha are proposed for wilderness classification, and are currently managed as de facto wilderness. About 8,600ha are managed for intensive visitor use. The rest of the area is maintained in its natural condition. Of the six classes, Class I (Recreation) contains 121ha; Class II (General Outdoor Recreation): 8,499ha; Class III

(Natural Environment): 43,100ha; Class IV (Outstanding Natural): 110,178ha; Class V (Primitive): 180,933ha; Class VI (Historical): 49ha.

STAFF There are 121 permanent staff and an additional 265 temporary personnel employed primarily for the summer season, May-September.

LOCAL ADMINISTRATION Superintendent, Sequoia and Kings Canyon National Parks, Three Rivers, California 93271.

VISITOR FACILITIES Sequoia National Park contains a number of visitor centres, campsites and supply facilities. Kings National Park has sparse facilities but does have four campsites. There are more than 1,300km of trails in the two parks.

SCIENTIFIC RESEARCH AND FACILITIES There have been basic management studies by independent investigators under supervision of a resident research scientist. Areas of past and present research include the ecology of Sequoiadendron giganteum; recreational carrying capacity of high elevation ecosystems; human impact on meadows; the ecology and behaviour of Ovis canadensis californiana and Ursus americanus; the role of fire in park ecosystems; cave studies; wilderness impact and effects of ozone and acid rain. A research centre is being developed to provide laboratory facilities and limited living accommodation. Additionally, Whitaker's forest, administered jointly with the University of California, provides accommodation for about 20 researchers. Facilities are also available at park headquarters.

MODIFICATION OF THE NATURAL ENVIRONMENT Herding of sheep (1850-1900) and cattle (1850-1940) have resulted in a significant change in composition and extent of upland and foothill vegetation. Fire suppression during the 20th century has interrupted successional patterns. Disturbance has been caused by overuse of campgrounds and developed areas and heavy use has created some pollution of the backcountry. Nearly two million persons visited the parks in 1975 with over 200,000 use nights recorded in the backcountry areas. The range and population of species such as Ovis canadensis and Martes pennanti have been affected by human disturbance. Alteration of ecosystems has resulted from years of fire exclusion. Heavy fuel buildups pose a threat from wildfire. Air pollution from outside the parks is a constant and ever-increasing threat to the parks' ecosystems, but the exact effects are undetermined. Weather modification has occurred over the Kings River Watershed for 20 years.

PRINCIPAL REFERENCE MATERIAL

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Vankat, J.C. (1970). Vegetation change in Sequoia National Park. Ph.D Dissertation, University of California, Davis.

Stanislaus-Tuolumne Experimental Forest

BIOGEOGRAPHICAL PROVINCE 1.20.12 (Sierra-Cascade)

LEGAL PROTECTION The Experimental Forest has been withdrawn from prospecting, location, entry, and purchase under the mining laws, and livestock grazing is not allowed. Experimental Forest lands are classed as Resource Value Class 6, the highest category considered for developing fire prevention, detection and attack plans.

DATE ESTABLISHED Accepted as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Middle western slope of the central Sierra Nevada, approximately 42km north-east of Sonora and 14km north-west of Yosemite National Park, California. The Experimental Forest consists of two tracts: Tract 1 (81ha) straddles the South Fork of the Stanislaus River, and Tract 2 (526ha) lies south of the North Fork of the Tuolumne River. 38°03'N, 119°57'W.

ALTITUDE 1,585-1,951m

AREA 607ha

LAND TENURE All land within Experimental Forest boundaries is federally owned and is administered by the Pacific Southwest Forest and Range Experiment Station, U.S. Forest Service.

PHYSICAL FEATURES The geology of the area consists of old granite outcrops with lava caps. Much of the terrain has been glaciated, leaving moraines. Topography is moderate to steep slopes, rounded ridges and saddles, and moderately deep canyons. Soils, which are derived from granite, are deep and well-drained sandy loams, and are fertile. Site quality for trees is high. Erosion is minimal. No watersheds are controlled. Most precipitation falls as snow. Annual precipitation over a 26-year period averaged 91cm and ranged from 51cm to 161cm. Air temperatures during the year usually range from 23°C to 35°C. The growing season is about 112 days. The lowest air temperature recorded during a 30-year period was -26°C and the highest 38°C. Average monthly minimum and maximum air temperatures ranged from -6.8°C and 7°C for January to 6°C and 27.7°C for July.

VEGETATION The forest cover type on 546ha is ponderosa pine-sugar pine-fir (SAF type 243), although it can be considered a variant because Douglas fir Pseudotsuga menziesii is absent and Jeffrey pine Pinus jeffreyi is present. The red fir forest cover type (SAF Type 207) covers 61ha. The main tree species are sugar pine Pinus lambertiana, ponderosa pine Pinus ponderosa, Jeffrey pine, colorado white fir Abies concolor, California red fir Abies magnifica and incense cedar Calocedrus decurrens. Lodgepole pine Pinus contorta grows on some moist sites, and California black oak Quercus kelloggii

grows on drier sites. Common brush species are manzanita Arctostaphylos spp., Sierra evergreen chinkapin Castanopsis sempervirens, mountain whitethorn Ceanothus cordulatus, bearmat Chamaebatia foliolosa and gooseberry Ribes sp. Herbs include Antennaria spp., Calochortus nuttallii, Geranium spp., Iris hartwegii, Lupinus spp., Potentilla congesta and Ranunculus spp. Many grasses are represented.

FAUNA Mule deer Odocoileus hemionus, deer mouse Peromyscus maniculatus, raccoon Procyon lotor, California grey squirrel Sciurus griseus, pocket gopher Thomomys sp. and black bear Ursus americanus are common.

ZONING None

STAFF None resident

LOCAL ADMINISTRATION Project Leader, Pacific Southwest Forest & Range Experimental Station, 1615 Continental Street, Redding, California 96001, U.S.A.

VISITOR FACILITIES Pinecrest, which is 1.6km from tract 2, is a large summer and winter recreation area, with resorts, campgrounds, organization camps, summer homes, swimming, boating, fishing and hunting. Strawberry, 1.6km from Tract 1, is a smaller summer home and resort community. The Dodge Ridge Ski Area lies about 2.3km from Tract 2. Roads in each tract provide easy access to the public.

SCIENTIFIC RESEARCH AND FACILITIES Early research included studies on reproduction, planting, pruning, slash disposal and lumber recovery. More recent studies involved climate, insects, mistletoe, harvest cuttings, site preparation, herbicides, and root rots. Trees in Tract 2 have been inventoried by stand-condition classes within 1ha divisions, providing an excellent data base. Several plantations, areas of natural young-growth, and large blocks of diverse species and age classes which are virtually uncut, provide great potential for silvicultural and ecological research in an important, complex timber type. The Experimental Forest is readily accessible but private transportation is required, and no official facilities are maintained.

LOCAL POPULATION 300 people in the Pinecrest-Strawberry community

MODIFICATION OF THE NATURAL ENVIRONMENT Water quality is high except for turbidity after storms. Minor streambank pollution along the South Fork of the Stanislaus River (Tract 1) and Sheering Creek (Tract 2) is caused by fishermen and hikers. Approximately 57ha of Tract 1 have been logged by the selection system and 262ha of Tract 2 were harvested in 1948 and 1949 to convert old growth to managed stands. Obtaining adequate reproduction of sugar pine by natural seeding and planting was stressed by seedtree cuttings and small clearcuttings. Most of the cutover areas now support small saplings and young-growth timber. About 174ha of Tract 2 are classified as virgin timber, although these stands have been entered to salvage dead or dying trees. The resident population of the Pinecrest-Strawberry community is about 300, but the summer population is more than 6,000, reaching peaks of 12,000. As many as 8,000 people are in the area on some winter weekends. Fishing along the South Fork of the Stanislaus River on Tract 1 is heavy. Other main uses on the Experimental Forest include motorcycle riding, hunting, and camping. Other than roads and a water system in Tract 1, no man-made structures exist in the Experimental Forest.

PRINCIPAL REFERENCE MATERIAL
Bibliography of 70 references available from MAB Secretariat in Paris or from local administration.

Three Sisters Wilderness

BIOGEOGRAPHICAL PROVINCE 1.20.12 (Sierra-Cascade)

LEGAL PROTECTION Established by U.S. Congress as a Wilderness in 1964, as an area to be protected and managed to preserve its natural conditions.

DATE ESTABLISHED Accepted as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION Astride the summit of the Cascade Range in State of Oregon with both east and west facing slopes. City of Eugene, Oregon located 80km to the west; Bend, Oregon 35km to the east. 44°N, 121°50'W.

ALTITUDE 600-3,407m

AREA 80,900ha

LAND TENURE All federally owned

PHYSICAL FEATURES Generally gentle to moderate mountainous topography (gently sloping plateau) except where dissected by stream and river drainages on the western margin and on the slopes of composite volcanoes, cinder cones, etc. Late Pliocene-Pleistocene-Recent pyroclastic rocks include basalt and andesite, three large composite volcanoes, numerous lesser vents, recent lava fields, and cinder and ash deposits. The reserve has permanent snowfields and glaciers, and numerous streams and small rivers (both glacial and non-glacial). The winter-wet, summer-dry climate, has an annual precipitation probably around 2000 to 2500mm but increasing with elevation on western slopes of range and declining rapidly to the east of the crest. Heavy (3-5m) winter snowpacks occur in subalpine zone.

VEGETATION Virgin coniferous forests, subalpine parklands, alpine rockfields. Forests below 1200m on the western slopes are dominated by douglas fir Pseudotsuga menziesii, western hemlock Tsuga heterophylla, lodgepole pine Pinus contorta, P. albicaulis and alpine fir Abies lasiocarpa. Extensive parkland from 1500-2000m which is a mosaic of forest patches and various subalpine meadow communities.

FAUNA Native fauna intact except for wolf.

ZONING/CONSERVATION MANAGEMENT Entire area is preserved as Wilderness, i.e. in its natural condition.

STAFF Figures not available, but administrative allocation is 5 man-years at minimum.

LOCAL ADMINISTRATION Forest Supervisor, Willamette National Forest, 211 E. 7th Avenue, Eugene, Oregon 97401.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Very little research has been carried out to date. Forests on western third are comparable with those of H.J. Andrews Experimental Forest with which this reserve is paired (i.e. functions as large control area and conservation reserve). Plant community studies (composition and structure) have been made of some of the forests and meadows. Extensive research on the geology of the region has been carried out.

LOCAL POPULATION There are no permanent populations in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT There is no permanent occupation or improvement by man. Recreational use (hiking and camping use) is moderate along trail systems. Some hunting and fishing occurs. No grazing by domestic stock except for saddle horses is allowed.

PRINCIPAL REFERENCE MATERIAL

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Virgin Islands National Park and Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 8.41.13 (Lesser Antillean)

LEGAL PROTECTION Total. Concurrent jurisdiction with Virgin Islands Territorial Government on those park lands in federal ownership. Code of Federal Regulations, Title 36, Chapter 1, provides major protection including natural resources, visitor safety and control of commercial activities. The establishing legislation for the park, passed on 2 August 1956, and added to on 5 October 1962, provides for the taking of certain marine animals by traditional methods to meet the food needs of the local population.

DATE ESTABLISHED 2 August 1956 (public law 925) as a national park; June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION On the island of St. John of the U.S. Virgin Islands, 88km east of Puerto Rico. 18°21'N, 64°44'W.

ALTITUDE 0-389m

AREA Park: 3,644ha land; 2,286ha sea. Biosphere Reserve: 6,127ha.

LAND TENURE 4,953ha are currently owned by the park. 1,174ha are in private ownership, including less than 20ha owned by the Territorial Government.

PHYSICAL FEATURES The park occupies about two thirds of the island and surrounding waters of St. John, the smallest of the three major US islands. On St. John and St. Thomas islands the earliest volcanic deposits of the northwest Caribbean lava flows are visible in many places. The park features steep, verdant hillsides, rising from rocky shores which are interspersed with coral sand beaches, numerous bays and cays. Clear, warm waters, fringing coral reefs, canyons of coral ledges, coral gardens, turtle grass beds, mangrove swamps, natural salt ponds. Various stages of reef development are apparent, from eastern Cinnamon Bay, where development is minimal, to Annaberg

and Mary Creek where the reef extends seaward over 100m, producing a broad, shallow back-reef. The shallowest fringing reefs, at eastern Cinnamon Bay, Windswept Beach and Denis Bay, are typically barren on their upper, wave-washed surfaces, which are occasionally exposed by extreme low tides. Climatic conditions vary from the drier, windward (eastern) exposures to the moist mountain top. Temperatures remain fairly constant around 26°C, and rainfall averages about 1000mm per year.

VEGETATION Forest and brush cover 70-85% of St. John Island. Vegetation varies from cactus and other arid land types to mahogany Swietenia spp., bay, genip and palms. A subtropical moist forest grows at the higher elevations in protected valleys. The lower elevations, southern and eastern slopes and less exposed coastal sites are primarily subtropical, dry forests. Along the southern and eastern shore, the trade winds and direct exposure to the sun have created a xerophytic vegetation. There is little grassland left where cattle and horses used to graze during the period following the sugarcane and cotton agriculture.

FAUNA The emergent reef crests support encrusting sponges, zooanthids, the sea urchin Echinometra sp., seaweeds and encrusting Millepora sp.. Seaward of the reef-crest, Acropora palmata stands, oriented in the direction of incoming waves, are interspersed with encrusting Diploria spp. and Millepora spp. The protected reef face is steep or overhung with Agaricia spp. and Cladocora spp. Montastraea spp. dominate the base of the reef (Robinson and Henle, 1978). The broad, shallow back-reefs support a dense growth of the alga Halimeda spp. and isolated patches of Porites porites. Mary Creek has dense growths of seagrass Thalassia spp. Offshore patch reefs, such as Johnson's Reef off Trunk Bay, are similar to the fringing reefs (Robinson and Henle, 1978). A low lying, shallow patch reef in the eastern part of Greater Lameshur Bay was surveyed in the course of a study of fish diversity (Risk, 1972). Corals present included Montastraea annularis, Millepora alcicornis, Porites furcata, and Agaricia agaricites. A variety of colourful tropical fish and invertebrates inhabit fringing coral reefs around St. John. Threatened sea turtles nest on beaches within park boundaries, and the mangrove swamp ecosystem supports breeding populations of many marine animals and birds, including the locally threatened white-crowned pigeon Columba leucocephala, the brown pelican Pelecanus occidentalis, brown booby Sula leucogaster, man-o-war bird Fregata magnificens, Bahamian pintail Anas bahamensis, Zenaida dove Zenaida aurita, moustached quail dove Geotrygon mystaceae. Terrestrial fauna includes all four vertebrate classes. Reptiles include the anoles lizards Anolis spp. and snakes. The amphibians are limited to frogs, and the only native mammals are several species of bats. Among the latter is the red fig-eating bat Stenoderma rufum, a rare species. Exotic and feral mammals include Murinae rodents, ungulates, and the destructive mongoose Herpestes auropunctatus. A still little-known invertebrate fauna, especially insects, is present.

ZONING/CONSERVATION MANAGEMENT Park lands are classified into four general zones - natural, historic, development, and special use. These zones are defined where various strategies of management and use will best fulfill management objectives and achieve the purpose of the park. Environmental protection zone (Trunk Bay) - 1%; outstanding natural features zone (coral reefs and park waters) - 5%; natural environment zone (land area) - 85%; historic zone (ruins) - 2%; development zone (developed areas) - 5%; special use zone (transport) - 2%. Following formal designation of the park as a biosphere reserve, the Virgin Islands Resource Management Cooperative (VIRMAC) undertook a detailed descriptive survey (as desribed above) in 1983 and 1984 and provided guidelines for management of the reserve and adjacent areas.

There are possession limit on conch, lobster and whelks. Turtles may not be caught under the U.S. Endangered Species Act of 1973 (Koester, 1985). Off-shore rod and reel fishing is the only form of fishing permitted and may not be carried out in the vicinity of public swimming or snorkelling beaches but nets of a maximum length of 20ft (6m) may be used within the park (Koester, 1985). The use or possession of any type os spearfishing equipment within the park boundaries is prohibited. All taking of marine life is prohibited in Trunk Bay and the defacing, breaking or removal of natural features, including underwater growth, is prohibited throughout the park. Water ski-ing is prohibited within the park.

STAFF Thirty-four full-time; 25 seasonal (1981). These employees carry out the maintenance, protection, interpretation, and administrative functions of the park.

LOCAL ADMINISTRATION Superintendent, Virgin Islands National Park, PO Box 806, Charlotte Amalie, St. Thomas, Virgin Islands 00801, U.S.A.

VISITOR FACILITIES The Cruz Bay Visitor Centre provides orientation talks, maps, literature, guided snorkel trips, hikes and cultural demonstrations. There is a self-guiding underwater trail at Trunk Bay and snorkel equipment can be rented at Trunk Bay and Cinnamon Bay. Seagrass anchorage sites have been studied at Lameshur and Francis Bays as part of a programme to establish long-term monitoring for existing safe anchorages. A series of reports on marine life and habitats around St. John is avialable. The park maintains a small reference library, and brochures have been produced for visitors. Caribbean cruises make day trips from St. Thomas; Trunk Bay and Cinnamon Bay are the main recreational areas. Coral Bay and Hurricane Hotel are important safe anchorages for boats during hurricanes or tropical storms (Boulon, R. pers. comm. to Nash, S., 1983).

SCIENTIFIC RESEARCH AND FACILITIES This relatively undisturbed tropical island provides excellent conditions for research and much has been carried out including some environmental monitoring and ecological research. The "Tektite" underwater program has been the largest effort (Lee et al., 1975). In cooperation with other local institutions and agencies, the Virgin Islands Resource Management Cooperative has recently completed a variety of studies within the reserve, including characterization of local fisheries, analysis of the cultural role of fishing, mapping of nearshore marine communities, descriptions of the bays and marine communities and lists of organisms found within the reserve area. Other projects emphasise watershed management, including development of long-term monitoring programs for coral reefs and fisheries and determination of the impact of terrigenous run-off on coastal ecosystems. A study of beach erosion within the park was carried out in the early 1970s (Hoffman et al., 1974). The Virgin Islands Ecological Research Station (Caribbean Research Institute of the College of the Virgin Islands).

MODIFICATION OF THE NATURAL ENVIRONMENT After 250 years of intensive agriculture on St. John's flatlands and much of the steep slopes, 200 years of selective cutting associated with charcoal making, and the introduction of many exotic species the vegetation barely resembles the natural forest. Gradual regrowth has brought back some forest, permanently altered by the absence of some native species and the presence of exotics. Roads and residential development are also present within the authorized park boundaries. Exotic burros and mongoose are present. Private development of real estate within the park's boundary is causing abnormal erosion of soil and detracts from the scenic landscape. The marine environment around St. John has remained relatively undisturbed, but there is some visitor impact on the

reefs of Trunk Bay, poaching of turtle eggs, coral collecting and boats anchoring on reefs. The underwater trail at Trunk Bay has been badly damaged by tourists, usually collecting coral momentos. There has been noticeable damage in some areas caused by people breaking corals while walking on reef flats, diving or swimming (Rogers, 1985). The reefs off Windswept Bay are regularly damaged by charter boats running aground. The Division of Fish and Wildlife have produced a number of reports on the fishing industry within the area. The majority of the subsistence fishermen who use the resouces of the reserve live on St. John but there are an unknown number of users from St. Thomas and the British Virgin Islands. Recreational fishermen from many of the adjacent islands make extensive use of the area. There is some conflict between the fishermen and park staff but, in general, the local people benefit from the park, despite losing their traditional economy.

PRINCIPAL REFERENCE MATERIAL

A series of reports on marine life and habitats around St. John is available. The park maintains a small reference library (see separate reference list).

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Yellowstone National Park

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION Protection is provided under several congressional acts. Hunting, logging, mining, and domestic livestock grazing are prohibited. Controlled fishing and camping are allowed.

DATE ESTABLISHED Created a national park on 1 March 1872; accepted as a Biosphere Reserve in June 1976; and accepted as a World Heritage Site in 1978.

GEOGRAPHICAL LOCATION In the southern portion of the northern Rocky Mountains, in the north-west corner of the state of Wyoming, adjacent to Montana and Idaho. The eastern boundary largely follows topographical divides but the remaining boundaries are defined by compass lines marked on the ground. 44°08'-45°07'N, 109°10'-111°10'W.

ALTITUDE 1,710-3,463m

AREA The Biosphere Reserve covers an area of 898,349ha. (824,263ha in Wyoming, 61,144ha in Montana and 12,743ha in Idaho).

LAND TENURE Federal government, except for 7.7ha.

PHYSICAL FEATURES The area is characterised by a volcanic plateau of two different ages, together with two smaller areas of exposed sedimentary rocks.

Quaternary rhyolitic flows, the majority resulting from the development of a large caldera about 600,000 years ago, cover the central and south-west segments of the park. The youngest flows occurred about 70,000 years ago. The topography is flat and undulating, determined by the various flows. The northern and eastern mountains are largely Tertiary age andesitic volcanics, with steep topography determined by erosion patterns, together with some exposed sedimentary rocks in the south-east part. The area contains the largest collection of thermal features in the world (about 3,000) including geysers, fumeroles, hot pools and springs. Yellowstone Lake, 37,127ha surface, is the one of the large lake in North America. Most of the area was covered by ice during the Pleistocene and many glacial features are present throughout the park. The Absaroka volcano contains the remains of 27 forests, each of which was successively buried by eruptions of ash. More than 100 specis of petrified plant have been found, mainly Sycamore Platanus spp. and Plantanophyllum spp., walnut Juglans sp., Magnolia spp., chestnuts Castanea spp., oaks Quercus spp. and redwoods Sequoia spp. Precipitation ranges from about 258mm at Gardiner to an estimated 2000mm in the south-west, falling mainly as snow during the winter months. Temperatures range from a January mean of -12°C to a July mean of 13°C at Lake Yellowstone in the centre of the park.

VEGETATION Forest vegetation predominates, with five species of coniferous tree recorded, lodgepole pine Pinus contorta forest making up the largest portion and forming a climax forest in many areas. Important forest canopy trees include Engelmann spruce Picea engelmanni, alpine fir Abies lasiocarpa, douglas fir Pseudotsuga menziesii and Pinus albicaulis. Limber pine Pinus flexilis and aspen Populus tremula are locally important. There are also small areas of semi-arid grassland, Artemisia shrub steppe and alpine tundra. Approximately 1,000 species of vascular plants are represented in total, including two endemics, Arabis fruticosa and Agrostis rossae. The thermal areas contain a unique assemblage of thermal algae and bacteria.

FAUNA Six species of ungulates are known from the park, moose Alces alces, mule deer Odocoileus hemionus, pronghorn Antilocapra americana, bighorn sheep Ovis canadensis, bison Bison bison and American elk Cervus elaphus, together with two species of bears, grizzly Ursus arctos and black U. americanus and 49 other species of mammals, including puma Felis concolor and wolverine Gulo gulo. The bison are the only wild, free-ranging bison in the United States that are naturally regulated. They were originally mountain bison but have interbred with plains bison. The wolf Canis lupus eromotus (V) occured here in the past, but its presence now is uncertain. Noteworthy bird include the trumpeter swan Cygnus cygnus buccinator, bald eagle Haliaeetus leucocephalus, golden eagle Aquila chrysaetos, osprey Pandion haliaetus and white pelican Pelecanus erythrorhynchos; all of which nest within the park. Fish include the Yellowstone cut-throat trout Salmo clarki bouvieri, found only in Yellowstone Lake and its tributaries, and the arctic grayling Thymallus arcticus.

CULTURAL HERITAGE Archaelogical investigations indicate the humans have visited the Yellowstone country about 10,000 years, but no group made it a permanent home.

ZONING/CONSERVATION MANAGEMENT There are three defined management zones: natural, 897,656ha; historic, 32ha; and development, 810ha. A fire management plan was adopted in 1976 to allow natural fires to burn in 70% of the park.

STAFF Permanent staff of about 590, of which 30 are assigned to administration, 180 to resource management, 56 to visitor protection, and 324

to maintenance. This core staff is augmented to over 600 in the peak season and in addition some 2,800 concession workers are employed over the summer.

LOCAL ADMINISTRATION Superintendent, National Park Service, PO Box 168, Yellowstone National Park, Wyoming 82190.

VISITOR FACILITIES A road system of almost 1,000km bisects the park, and adjacent developed areas have large campgrounds and other visitor facilities. Annual visitors total nearly three million.

SCIENTIFIC RESEARCH AND FACILITIES A resident research staff is conducting research into the large ungulates, fisheries and vegetation. Fire-related topics are also being studied. More than 100 independent researchers are presently working within the park. Research projects requiring a natural environment or orientated to management problems are given preference. Research requiring modification of the biota or environment is not permitted. The large area where natural processes (including fire) are allowed to operate make the park an excellent area for research on natural processes. Limited laboratory space is available. Two mobile research laboratories have been provided by the Northern Rocky Mountain Cooperative Park Studies Program administered by the University of Wyoming. Access to back-country is normally restricted to non-mechanized means, however a helicopter may be used with the superintendent's permission for approved projects.

LOCAL POPULATION A permanent community of about 300 people associated with park operations is located at Mammoth, the administrative headquarters.

MODIFICATION OF THE NATURAL ENVIRONMENT Several species of fish have been introduced, resulting in the eliminiation of brook trout Salvelinus fontinalis, lake trout S. namycush, brown trout Salmo trutta, lake chub Couecius plumbeus and a redution of the native cut-throat trout Salmo clarki and grayling Thymalius sp. Surface mining, oil and gas exploration and extraction, and development of geothermal resources near park boundaries are potential threats to park air and water quality and visual integrity, as well as threatening the critical habitat of the grizzly bear. This habitat and that of the pronghorn Antilocapra americana are also threatened by subdivision and development of private property. Fire suppression has also been a major departure from natural conditions. Gray wolves Canis lupus were extirpated by 1926.

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Beaver Creek Experimental Watershed

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION 97% of the area is a National Forest which must be managed under the specific direction of land management plans. Activities are governed by federal law, regulation, policies and land management plans prepared, maintained, and periodically revised by the Coconino National Forest in accordance with changing national needs and public desires.

DATE ESTABLISHED Approved as a Biosphere Reserve in April 1978

GEOGRAPHICAL LOCATION 50km south of Flagstaff, Arizona, in Coconino and Yavapai counties. 34°32'N, 111°65'W.

ALTITUDE 900-2400m

AREA 111,300ha

LAND TENURE The National Forest is federal property; 0.5% is National Monuments (also federal) and the remainder is privately owned. Approximately 850 ha of National Forest are classified as base-for-exchange, meaning they may be traded for private lands within National Forests in Arizona classified as desirable for acquisition. Much of the land is used under grazing permit by local ranchers for cattle grazing. The Woods Land Use Plan has been completed and described the management of 27,400ha.

PHYSICAL FEATURES A high plateau, sloping mesas and breaks, steep canyons and valleys characterize the topography of the Beaver Creek Watershed. Bedrock underlying the area consists of igneous rocks of volcanic origin, below which are sedimentary rocks of Kaibab, Coconino, and Supai formations. Prominent mountains on the watershed include Fain, Lake, Jones, Bill Back Butte, Apache Maid, and Round. Stoneman Lake lies within the watershed area; major drainages are Dry Beaver Creek, Rattlesnake Draw, Red Tank Draw, and Wet Beaver Creek, all of which join and enter the Verde River near Camp Verde, Arizona. One Interstate Highway crosses the area, linking Flagstaff and Phoenix.

VEGETATION Three vegetation types are found in the Beaver Creek watershed. In descending order with respect to elevation, these types are ponderosa pine Pinus ponderosa, pinyon-juniper (including alligator juniper and Utah juniper

subtypes), and semi-desert shrubs. A detailed list of species occurring in the three vegetation types is available.

FAUNA Many species of wildlife, both game and non-game, are found within the Beaver Creek Watershed, including both resident and migratory species. A detailed list of the species of fauna found, by vegetation type, within the area, is available.

CULTURAL HERITAGE Montezuma Castle and Montezuma Well are located along the Beaver Creek in the Verde Valley. The castle was built in about AD1250 by Hokokam Indians and consists of a five storey dwelling, 60 rooms and accommodated up to 200 people.

ZONING/CONSERVATION MANAGEMENT Some "zoning" currently exists for purposes of multiple use management. This includes both Multiple Use Management Zones (Intermediate, Woodland, Travel Influence and Water Influence) with general management direction and management units. A land use plan for the Woods Planning Unit covers 27,400ha of the area, and similar plans have been in effect for the entire area since 1985.

STAFF No staff are assigned exclusively for management or protection for MAB purposes. The area, which is part of four of seven Range Districts of the Coconino National Forest, is managed along with the rest of the Forest. The staff of the Beaver Creek Multiresource Evaluation Project and their cooperators spend a major part of their research effort on the area.

LOCAL ADMINISTRATION Forest Service Administrator of the Land, Supervisor, Coconino National Forest, PO Box 1268, Flagstaff, Arizona 86002, U.S.A.

SCIENTIFIC RESEARCH AND FACILITIES Research on the Beaver Creek Watershed began in 1962 after several years of preliminary work and construction of stream gauging stations, and the effects of a range of forest management treatments are being investigated. Pilot watersheds ranging from 27ha to 820ha were created to facilitate the work, and two larger watersheds, Woods (4,330ha) and Bar M (6,670ha), were formed to test treatments on an operational scale. Impacts of the treatments were measured on a wide range of ecosystem parameters, including hydrologic response, timber and forage yields, soil erosion and sediment production, water quality, scenic beauty, and the dynamics of insect, bird, small animal and big game populations. In addition, several small "homogeneous" watersheds were created within the larger pilot research watersheds to provide data for ecosystem model testing. Ecosystem simulation models are being developed for use by forest managers in estimating commodity production and in evaluating impacts of alternative forest and natural resource management problems. The models will have broad application to forest and range lands; some will apply to areas similar to those of the south-western United States, while others will apply to comparable areas throughout the world. The Beaver Creek Watershed is readily accessible from Flagstaff or from the Verde Valley by motor vehicle on the Interstate Highway which traverses the watershed. A second paved highway from Flagstaff passes through the eastern extremities of the watershed, and most of the research watersheds are accessible by secondary, gravel or cinder-surfaced roads. There is no information on scientific research facilities within the Beaver Creek Experimental Watershed.

MODIFICATION OF THE NATURAL ENVIRONMENT Since the late 19th century, the area has had various degrees of modification by man, the earliest being the introduction of domestic livestock. Most of the ponderosa pine area has been logged, thus changing the size and age class distribution from "natural", but

not the ecosystem. Protection from natural fire since the early 1900s has had a slow but cumulative effect. In the early 1960s approximately 16,500 ha of pinyon-juniper woodlands (both alligator and Utah juniper) were converted by chaining and pushing for range and water yield improvement purposes. In addition, fences, water developments, etc. have been constructed on the watershed for management. In the lower end of the Reserve, near the Verde River, several small unincorporated residential communities have developed in recent years. Some smaller summer-home type developments are found at high elevations, e.g. Stoneman Lake. Approximately 7000 vehicles cross the area daily using the Interstate Highway.

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Konza Prairie Research Natural Area

BIOGEOGRAPHICAL PROVINCE 1.18.11 (Grasslands)

LEGAL PROTECTION No statutory protection

DATE ESTABLISHED Approved as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION In Kansas, Riley and Geary counties, 7-15km south of Manhattan, Kansas. 39°03'-39°08'N, 96°31'-96°37'W.

ALTITUDE 320-444m

AREA 3,487ha

LAND TENURE 371ha are owned by the Kansas State University Endowment Association with a clause stating that if it is not used for purposes that maintain the natural area status, ownership shall revert to the Nature Conservancy. The rest (3116ha) is owned by the Nature Conservancy, and is under lease to Kansas State University, Division of Biology, for ecological research on bluestem (Andropogon spp.) prairie.

PHYSICAL FEATURES Konza Prairie is a representative sample of bluestem (tallgrass) prairie. It is a dissected upland with hard chert-bearing

limestone layers which result in steep-sided hills, on which are exposed the Permian limestone and shale layers. The ridges are characteristically flat, with shallow, rocky soils. The larger and wider valleys have deep permeable soils. One watershed, almost completely contained within the boundaries, occupies about two-thirds of the area.

VEGETATION About 90% of the area is unploughed native bluestem (tallgrass) prairie, nearly all in good to excellent condition; about 6% is native forest in valleys (expanded somewhat from presettlement areas), and about 4% of lowland areas has been ploughed.

FAUNA White-tailed deer Odocoileus virginianus, coyotes Canis latrans, greater prairie chicken Tympanuchus aipido and upland sandpipers Bartramia longicauda are representative.

ZONING/CONSERVATION MANAGEMENT None at present

STAFF No information

LOCAL ADMINISTRATION Director of Konza Prairie, Division of Biology, Kansas State University, Manhattan, Kansas 66506.

SCIENTIFIC RESEARCH AND FACILITIES This is the largest area of native bluestem prairie preserved for ecological research. Between 1972 and 1975 replicated trials were started on various times and frequencies of burning and mowing. In 1977 the area was greatly enlarged, and it is now planned to expand the experiments to include entire watersheds. Plans also call for burning small areas in summers when it is dry enough to burn, to assess the effects of fires caused by lightning. These experiments should increase understanding of the natural ecosystem, provide an opportunity to compare the natural with grazed and cultivated systems derived from it, and reveal unintended effects of manipulations. In the future, bison, elk and pronghorn will be reintroduced and there will be research on cattle and feral horses. Burning treatments will be combined with grazing. It is hoped to assess the effect of these treatments on water runoff quality and quantity, and erosion rates. There is no information available for the research facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT About 4% of lowland areas have been ploughed, much planted to smooth bromegrass Bromus inermis. A headquarters in the north-western part of the area consists of a large livestock barn and associated corrals, a 3-story limestone house, a wood house, an enlarged mobile home, two equipment sheds, and two hay sheds. Another house and barn are located 2km east. A temporary shed is present by the south entrance. The entire area has been grazed by cattle for about 125 years, often summer only at moderate stocking rates, and it has been burned more than half the years, which is helpful in maintaining native prairie.

PRINCIPAL REFERENCE MATERIAL
Leaflets, a report for 1972-4, and publications in scientific journals.

Niwot Ridge Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.19.12 (Rocky Mountains)

LEGAL PROTECTION No information

DATE ESTABLISHED Approved as a Biosphere Reserve in May 1979

GEOGRAPHICAL LOCATION Part of Roosevelt National Forest, sharing a boundary with Boulder City Watershed along its south-east edge. 35km west of Boulder, and 65km north-west of Denver. This area completes a 3-unit biosphere reserve cluster in the Central Rocky Mountains of Colorado, together with the Fraser Experimental Forest and the Rocky Mountain National Park. 40°00'N; 105°30'W.

ALTITUDE 2,866-3,780m

AREA 1,200ha

LAND TENURE Federal government

PHYSICAL FEATURES The reserve contains cirques, glacial troughs, cols, summit surfaces, broad interfluves, nivation hollows, glaciers, talus, rock walls, alluvial fans, rock glaciers, stone-banked lobes and terraces, turf-banked lobes and terraces, soil creep and associated mass movement phenomena, active and fossil patterned ground; permafrost, unglaciated terrain with deep soil profiles and tors.

VEGETATION Western spruce fir forest covers 450ha; lodgepole pine subalpine forest 350ha; alpine meadows and barren 352ha; ponderosa shrub forest 50ha.

FAUNA This includes tufted-ear squirrel, pine squirrel Sciurus aberti, porcupine Erithizon dorsatum, mule deer Odocoileus hemionus, American elk Alces alces, coyote Canis latrans and white-tailed ptarmigan Lagopus leucurus.

ZONING/CONSERVATION MANAGEMENT The site integrity is well maintained by the surrounding National Forest and city watershed regions, Adjacent parts of the Roosevelt National Forest have been designated as wilderness and thus provide a buffer zone around the proposed biosphere research area. In addition, the Boulder City Watershed abuts the proposed research area all along the south-west edge and is completely closed to public use but has been used for certain experimental projects. The Rocky Mountain National park lies to the west of Niwot Ridge.

STAFF None

LOCAL ADMINISTRATION Arapaho and Roosevelt National Forests, Federal Building, 301 S. Howes, Fort Collins, CO 80521.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The University of Colorado, through its Institute of Arctic and Alpine Research (INSTAAR), has operated a research and educational programme in the Indian Peaks area (including Niwot Ridge) of the Colorado Front Range since 1950. A climatological record has been kept since 1951 at four main stations, spread through a range of altitudes from 2,500-3,750m. Together they present environmental data representative of the four major ecosystem belts of the Front Range east slopes: the foothills (2,000-2,600m); the lower montane (2,600-3,066m); the upper montane (3,066-3,666m); and the alpine (3,833m to the summits). The largest single research undertaking is the analysis of the alpine tundra ecosystem funded by the National Science Foundation. This includes a wide range of interdisiplinary projects from the study of the feeding ecology of the white-tailed ptarmigan to the assessment of primary productivity and energy balance-ground temperature determinations. With this as the core, several

applied studies are being developed, such as analysis of the impact of snowmobiles on the alpine tundra and determination of the total bearing capacity of different tundra ecosystems for human use. Studies on permafrost, geomorphology, climatology, glaciology and various additional aspects of plant and animal ecology are also being carried out.

MODIFICATION OF THE NATURAL ENVIRONMENT INSTAAR has established four weather stations at 2,200m, 2,590m, 3,049m and 3,750m. There is a road to the weather stations (dirt), 4-wheel drive. Light foot travel is allowed through the areas. There are four emergency shelters above forest limit.

PRINCIPAL REFERENCE MATERIAL
An extensive bibliography of past research is available.

The University of Michigan Biological Station

BIOGEOGRAPHICAL PROVINCE 1.18.11 (Grasslands)

LEGAL PROTECTION A state wildlife sanctuary in which hunting, trapping, camping and fires are prohibited. No vehicles are permitted off designated roads. The Station is under the protection of Station staff, the state police, and Michigan Department of Natural Resources.

DATE ESTABLISHED The station was established in 1909 and accepted as a Biosphere Reserve in May 1979

GEOGRAPHICAL LOCATION On the tip of the lower peninsula of Michigan. 25km south of the straits of Mackinac, 22km west of the city of Cheboygan and 10km east of the town of Pellston, on the shores of Douglas Lake and Burt Lake. 45°34'N, 84°40'W.

ALTITUDE 183-280m

AREA 4,048ha

LAND TENURE Owned by the University of Michigan since its establishment in 1909.

PHYSICAL FEATURES The entire area was glaciated. The surface has been altered by post-glacial lake development. The soils are variable. The relief is 30% flat, 70% undulating with occasional steep hills. The park includes two creek watersheds, one completely within property boundaries. The upper three great lakes are within 30-90 minutes' driving. 11km of natural undeveloped shoreline is included within the Park.

VEGETATION Representative vegetation is: northern hardwood 1,400ha; northern fir 400ha; Great lakes pine 2,000ha; conifer bogs 200ha; and Great Lakes spruce fir 50ha. Specific unique features include bogs, marshes, swamps and fens, beach pools, white cedar Thiya occidentalis swamps and virgin white pine Pinus monticola stands.

FAUNA This includes white-tailed deer Odocoileus virginianus, black bear Ursus americanus, bobcat Felis rufus, porcupine Erithizon dorsatum, fox Vulpus spp., coyote Canis latrans, gray Scurius grisens, red and fox squirrel S. niger, beaver Castor canadensis, raccoon Procyon lotor, loons Gavia spp.,

sandhill cranes Grus canadensis, ruffed grouse Bonasa umbellus and 100 species of birds nesting on the property.

ZONING/CONSERVATION MANAGEMENT A central core of completely protected reserve (1,000ha) is surrounded by the balance of the property which serves as a buffer zone. There is an overall management plan.

STAFF Twenty permanent staff and about 68 visiting staff

LOCAL ADMINISTRATION The University of Michigan Biological Station, Pellston, MI 49679.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There is a 70-year history of research and teaching which has produced much information that will be useful as a baseline for future experimental studies. Experimental plots and control areas have been established and a wide range of research is taking place. Current research involves ecology, systematics, limnology and field biology.. The research facilities include 2600 sq. m research laboratory, boatwell, library, three small dormitories, teaching laboratories, a large dining room, 9 year-round residences and 100 other cabins and buildings. There is easy access to research sites via roads or water. The Pellston airport with major commercial airline flights is only 10km away via highway. A 1200ha research and teaching area, the Chase S. Osborn Preserve, is also under the administration of the Biological Station. It is located 120km north-east of the Station, on Sugar Island in the St Mary's River on the Canadian-American border. Being adjacent to the Canadian Shield, it contains a number of quite different habitats from the Station to the south.

LOCAL POPULATION Low

MODIFICATION OF THE NATURAL ENVIRONMENT The area was extensively logged 60-90 years ago, with resultant fires, but there are no structures on the property except the Station's facilities occupying an 8ha site. The region has a generally low population and rural character with tourism a major industry.

PRINCIPAL REFERENCE MATERIAL
Over 1000 publications have been produced mainly in ecological journals and systematic journals.

The Virginia Coast Reserve

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern forest)

LEGAL PROTECTION No statutory protection

DATE ESTABLISHED Accepted as a Biosphere Reserve in May 1979

GEOGRAPHICAL LOCATION The reserve stretches along the southern seaward edge of the Delmarva Peninsula, for about 82km. It is bordered on the east by the Atlantic Ocean and on the west by marshes or mainland of the Virginia portion of the Delmarva Peninsula. 37°05'-37°34'N, 75°56'-75°37'W.

ALTITUDE 0-10m

AREA 13,511ha

LAND TENURE Thirteen islands (Metomkin, Cedar, Parramore, Revels, Sandy, Hog, Rogue, Cobb, Ship Shoal, Godwin, Myrtle, Mink and Smith) are owned and protected by the Nature Conservancy with the exception of much of Cedar and small parts of Hog and Smith Islands. Five other barrier islands and one marshland island are administered in their natural state by government agencies (Fisherman's Island - U.S. Fish and Wildlife Service National Wildlife Refuge; Wreck Island - Virginia Division of Parks Natural Area; Mochorn Island - Virginia Division of Game and Inland Fisheries Wildlife Sanctuary; Wallops Island - National Aeronautics and Space Administration Experimental Facility; Assateague Island - United States Department of the Interior National Seashore and National Wildlife Refuge).

PHYSICAL FEATURES The reserve consists of a series of low-lying barrier - and marshland - islands bordered on the east by the Atlantic Ocean. At intervals along the coast inlets connect the sea with the extensive lagoon system to the west of the reserve. These lagoons typically have salinities of 25-34 parts per thousand. The tidal range along the ocean front of the islands normally averages 1.3m but may reach 2.7m or more during excessive storm surges. The extensive marshes behind the barrier islands are well-flushed by tidal action. Brackish and fresh water occurs in the interior of the larger islands at the head of their upland drainages or as small ponds.

VEGETATION The islands contain an excellent representation of the vegetation communities typical of mid-Atlantic barrier islands. These include mud flats, saltmarsh, fresh and brackish water wetlands, maritime thickets, upland evergreen forests, maritime deciduous forests, dune grasslands, and beach vegetation communities. They contain many species at the northern, eastern, and southern extremes of their ranges, for example Yaupon holly Ilex vomitaria, sea oats Uniola paniculata, ground cherry Physalis viscosa subsp. maritima and live oak Quercus virginiana.

FAUNA The land vertebrates include 16 native mammals, the Smith Island cottontail, being an endemic subspecies. There are many insular populations of predators including red fox Vulpes vulpes, raccoon Prozyon sp., mink Mustela vision and otter Lutra canadensis. Wintering waterfowl populations include very substantial numbers of black duck Anas rubripes, snow goose Anser caerulescens, and many other species. Summer breeding populations of colonial beach nesting birds include thousands of black skimmer Rynchops niger, oyster catcher Haematopus ostralegus, common tern Sterna hirundo, royal tern Thalasseus maximus, laughing gull Larus atricilla, and others. Colonial wading birds include vast heronries of common egrets, snowy egrets Egretta thula, night heron) and glossy ibis Plegadis falcinellus. The herpetofauna of the islands includes many species typical of the mid-Atlantic coastal plain. They are noteworthy for their pattern of distribution on the individual islands where they occur and for the biogeographical patterns that this distribution illustrates. The peregrine falcon Falco peregrinus and the loggerhead sea turtle are endangered.

ZONING/CONSERVATION MANAGEMENT The upland areas of the islands are administered as nature sanctuaries. In these areas only passive day use is permitted; overnight camping, motor vehicles, and domestic pets are prohibited. Low saltmarsh areas to the west of most of the islands are open to waterfowl hunting by permission from the Nature Conservancy.

STAFF Two permanent personnel are assigned management and maintenance duties for the Virginia Coast Reserve and for its mainland headquarters.

LOCAL ADMINISTRATION No address available

VISITOR FACILTIES No information

SCIENTIFIC RESEARCH AND FACILITIES Research on the area had been slight up until the Virginia Coast Reserve Study. This document, compiled by the Nature Conservancy, summarises 8500 man hours of research much directed at establishing the facts needed to protect the islands as a functioning natural system. Easier access to the islands for researchers is being provided. There is no information available on the scientific facilities in the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT There has long been human influence but it has not generally altered the reserve's integrity. The rserve has been traditionally used for pasture land, pirateering, waterfowl and shorebird marketing hunting, resort development, and home sites. These human impacts have had little long-term effect on the function of the islands' natural systems. Their isolation and inaccessibility protect them from most direct human influences.

PRINCIPAL REFERENCE MATERIAL

The Virginia Coast Reserve Study (1976). The Nature Conservancy, Library of Congress.

Hawaii Islands Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 5.03.13 (Hawaiian)

LEGAL PROTECTION Total

DATE ESTABLISHED The Biosphere Reserve was approved in 1980, its individual parts being established in 1916 (Hawaii Volcanoes National Park) and 1960 (Haleakala National Park).

GEOGRAPHICAL LOCATION The Hawaii Volcanoes National Park lies on the south-east portion of the Island of Hawaii itself, the easternmost island of the State of Hawaii, whilst Haleakala National Park is on the island of Maui, some 40-50km north-west of Hawaii Island.

ALTITUDE 0-3,055m (Haleakala) and sea level to 4,170m (Hawaii Volcanoes)

AREA The size of the biosphere reserve is 99,545ha, composed of 11,462ha of Haleakala National Park and 87,940ha of the Hawaii Volcanoes National Park.

Hawaii Islands Biosphere Reserve: Hawaii Volcanoes National Park

BIOGEOGRAPHICAL PROVINCE 5.03.13 (Hawaiian)

LEGAL PROTECTION Hawaii Volcanoes National Park is protected under 16 U.S.C. 1 (National Park Service Organic Act) and under the terms establishing the park as set out in 16 U.S.C. 395b, and under several sections of 16 U.S.C. 391-396a which specifically pertain to Haleakala. Section 394 states that

"The regulations promulgated shall provide for the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible", while Section 395c states that "All hunting or the killing, wounding, or capturing at any time of any wild bird or animal, except dangerous when it is necessary to prevent them from destroying human lives or inflicting personal injury, is prohibited within the limits of said park in any other way than by hook and line, and then only at such seasons and in such times and manner as may be directed by the Secretary of the Interior."

DATE ESTABLISHED Created a national park on 1 August 1916 by Act of the U.S. Congress (39 Stat. 432), split into Hawaii Volcanoes National Park and Haleakala National Park in 1961 (75 Stat. 577); accepted as a Biosphere Reserve in 1980, together with Haleakala National Park.

GEOGRAPHICAL LOCATION In the south-east of the Big Island of Hawaii, including the summit and south-east slope of Mauna Loa and the summit and south-western, southern and south-eastern slopes of the Kilauea Volcano. 19°11'-19°33'N, 155°01'-155°39'W.

ALTITUDE 0-4,170m

AREA 87,940ha (Previously 99,000ha of which 92,934ha given as the biosphere reserve area.)

LAND TENURE Park created from federally-owned land donated from the State of Hawaii. Act of 1920 (41 Stat. 452) authorized the acquisition of privately owned land and rights of way.

PHYSICAL FEATURES The park extends from the southern coast to the summit calderas of Kilauea and Mauna Loa volcanoes. Mauna Loa is a massive, flat-domed shield volcano built by lava flow layers and is considered to be the best example of its type in the world, and extends from 6,096m below sea level to 4,103m above. These are among the world's most active volcanoes and exhibit constantly changing features such as its two principal rift zones containing extensive recent flows. Since 1969 new flows have spread over 78 sq. km of the park and added 81ha of new land to the island. An unusual feature in the park, is an area which has sunk 3.4m into the sea as a result of an earthquake several years ago. The Halemauman fire pit was a continuously active laval lake into the early 1900s and others existed along the Chain of Craters and on Mauna Ula (a new lava shield, 12km long extending into the sea). Eruptive activity which began in January 1983 in the East Rift Zone, continues at frequent intervals. The volcanoes lie in the path of the north-east tradewinds and their windward slopes receive a mean annual rainfall of 3810mm (but due to the extremely porous fresh lava, there are no running streams in the park), while the leeward receives only 381mm; with such dry conditions the vegetation on this slope grades into desert. The climate varies with altitude from tropical humid to alpine desert with average temperatures ranging from 22°C at sea level to 7°C at 3,400m and cooler still on the summit of Mauna Loa.

VEGETATION The park encompasses a mosaic of vegetation stages, plant community types and soil development stages resulting from the interaction of its geophysical properities and its biota. Small islands of vegetation, formed by successive lava flows, illustrate various successional communities further diversified by altitudinal rainfall patterns. The submontane forest area of the park is unusual in that the low annual rainfall has impeded species diversification. Twenty-three distinct vegetation types have been

described for the park, ranging from lush rainforest to sparse desert, grouped into five major ecosystems namely, subalpine, montane seasonal, montane rainforest, submontane seasonal and coastal lowlands. The windward Hawaiian rainforest communities include such species as ohia Metrosideros collina (the first tree to appear on new lava), lama Diospyros sp., tree fern Cibotium chamissoi, uluhe fern Gleichenia and mixed koa Acacia koa - a'e Sapindus stands. These grade on lee slopes through upland shrublands, ohia-native shrub forest, dryland native shrubs, closed perennial grasslands of native Deschampsia australis and introduced Holcus lanatus, to desert and alpine stone desert. The Olaa Forest tract, over 4,000ha in size, is probably the largest remaining tract of virgin ohia and fern forest in the Hawaiian Islands. Some of the endemic plant species are confined to a single valley or mountain slope, with native flora numbering 41 species, with a further 40 listed as rare and warranting special attention.

FAUNA The only native land mammal is the Hawaiian hoary bat Lasiurus cinerueus semotus which is listed as endangered in the U.S. whilst a number of vulnerable, endangered, and rare bird species present include nene goose Branta sandvicensis, Hawaiian hawk or io Buteo solitarius (R), Hawaiian crow Corvus tropicus (E) and three honeycreepers, the akepa Loxops coccinea coccinea (V), the akiapola' au Hemignathus wilsoni (E) and the ou Psittirostra psittacea (E). The primary habitat for the ou is the Ola'a Forest, where it was last recorded in January 1984. In 1967, small breeding populations of another endangered species, the Hawaiian dark-rumped petrel Pterodroma phaeopygia sandwichensis (E), were discovered in the vicinity of Puu Keokeo, a 6,800ft cinder cone on Mauna Loa's south-west rift. No other populations of this extremely rare and threatened seabird are presently known on the island of Hawaii. Other birds known from the park include the short-eared owl Asio flammeus and many endemics such as the Hawaiian thrush Phaeornis obscurus, elepaio Chasiempis sandwichensis, amakihi Loxops virens, creeper L. maculata, apapane Himatione sanguinea and iiwi Vestiaria coccinea. Fish are not found within the park but are found along the 48km coastline. Coral reefs are limited to a small area near Halape where common reef fishes are found.

CULTURAL HERITAGE There are remains of native villages, heiaus (temples), canoe landings petroglyphs and shelter caves, and two major archaeological sites, Waha'ula Heiau ruins and the puu Loa petroglyph field, representing early Hawaiian culture. Christian influences started in or around 1823, with churches and schools built by the mid 1800's. Extensive ruins of stone structures dating back to the time of Paau in AD 1275 are present.

ZONING/CONSERVATION MANAGEMENT The park is divided into two segments, the sectors with Mauna Loa and Kilauea (84,033ha) and the Ola'a Forest Tract (3,907ha), the latter separated from the major sector by several small parcels of private land. Act of Congress formally designated 49,818ha as Wilderness Lands (P.L. 95-825). The park is divided into three land-use zones: Primary use zone for concentrated visitor use, interpretative programmes such as the Crater Rim summit loop drive, the Chain of Craters Road corridor and the Waha'ula Visitor Centre areas; wilderness threshold zone, comprising a self-guiding nature area used almost exclusively by local island residents and off-island visitors who rent vehicles; and back country zone, the largest and least-used zone. Hunting of wild pigs and goats which are exotic to the park is permitted because these animals present substantial problems to other fauna and flora endemic to the park.

STAFF There are 34 permanent full time, about 20 permanent less than full time, 39 seasonal and 50 members from the Young Adult Conservation Corps (YACC). There are eight staff on the Science Program.

LOCAL ADMINISTRATION Superintendent, Hawaii Volcanoes National Park P.O Box 52, Hawaii National Park, Hawaii 96718.

VISTOR FACILITIES Facilities include the Volcano Howe and two campgrounds. Hiking and fishing are two of the major activities.

SCIENTIFIC RESEARCH AND FACILITIES There is a volcanic geological research programme at the Hawaiian Volcano Observatory and Mauna Loa and Kilauea are the most studied and best understood volcanoes in the world. The U.S. Fish and Wildlife Service, the U.S. Forest Service and the National Park Service are studying endangered birds. The University of Hawaii together with park staff are studying exotic plants and animals and methods of their reduction and the restoration of native species and many of the International Biological Programme island ecosystem studies were based here. The US Geological Survey's Hawaiian Volcano Observatory, the University of Hawaii/National Park Service Research Station and the Fish and Wildlife Service Mauna Loa Field Station are situated in the park. The park maintains six weather stations which include air temperature, rainfall, wind speed, wind direction and relative humidity, and six other stations covering rainfall. There are programmes for the monitoring of feral goat, feral pig and native Hawaiian goose movement through the use of radio transmission collars and radio telemetry. In addition there are several vegetation plots with transects, and three air qualtity monitoring stations.

MODIFICATION OF THE NATURAL ENVIRONMENT Direct removal or alteration of native forest for growing sugar, pineapple plantations, ranching and logging, has altered the natural state of the forest habitats. Ranching activities and the introduction of species such as the pig Sus scrofa and goat Capra hircus (previously 15-20,000 now 10) have had serious biological consequences, including destruction of native ecosystems and widespread extinction of endemic species. Mongooses, cats, dogs, and several species of alien birds and insects continue to disrupt native ecosystems. Heavy goat browsing still denudes the landscape of shrubs and prevents regeneration of many native plant species. The black rat Rattus rattus, Norway rat R. norvegicus and mongoose Herpestes auropunctatus are also found in the park. Recently introduced exotic plants are invading native communities and causing severe disruptions. The effect of the presence of Kilauea Military Camp is unknown.

PRINCIPAL REFERENCE MATERIAL

There are some 63 main references and eight management plans, the most relevant being:

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Hawaii Islands Biosphere Reserve: Haleakala National Park

BIOGEOGRAPHICAL PROVINCE 5.03.13 (Hawaiian)

LEGAL PROTECTION Legal status since 1916 when authorized as part of Hawaii National Park under Act of United States Congress (39 Stat. 432), and separated into a full national park in 1981 (75 Stat. 577). Since then protected under 16 U.S.C. National Park Service Organic Act, also under the terms establishing the park as set out in 16 U.S.C. 395b, and under several sections of 16 U.S.C. 391-396a which specifically pertain to Haleakala. Section 394 states that "The regulations promulgated shall provide for the preservation from injury of all timber, birds, mineral deposits, and natural curiosities or wonders within said park, and their retention in their natural condition as nearly as possible", while Section 395c states that "All hunting or the killing, wounding, or capturing at any time of any wild bird or animal, except dangerous when it is necessary to prevent them from destroying human lives or inflicting personal injury, is prohibited within the limits of said park in any other way than by hook and line, and then only at such seasons and in such times and manner as may be directed by the Secretary of the Interior".

DATE ESTABLISHED Created a national park in 1916 as part of Hawaii National Park; split from Hawaii Volcanoes National Park in 1960; accepted as a Biosphere Reserve in 1980, together with Hawaii Volcanoes National Park.

GEOGRAPHICAL LOCATION Maui County in the eastern portion of Maui Island, State of Hawaii. 20°39'-20°47'N, 156°02'-156°16'W.

ALTITUDE 0-3,055m

AREA 11,462ha with Biosphere Reserve status which applies only to all parkland above the 366m contour line. National Park area is 11,605ha.

LAND TENURE Federal, 97.8%; private, 2.2% and less than 100ha (mostly Kipahulu coastal area). The Federal Government has exclusive jurisdiction over all lands within the park boundaries.

PHYSICAL FEATURES The park extends from the summit of Mount Haleakala, south-eastwards to the coast. The 900m deep "crater" is a water-carved depression resulting from erosion by two major streams, which has subsequently been partly filled by later lava flows and numerous cinder cones. The topography of the crater, which is 43km in circumference, consists of vents, lava tubes and flows, basaltic dikes, and rock, stone and cinder deserts. There is no evidence of major eruptions in the last 1200 years, but in 1790, two minor flows at lower elevations appear to have altered the coastline outside the park. Kipahulu Valley is located on Haleakala's eastern flank. As with the crater, it was formed by stream erosion and partly refilled by lava flows, which helped to produce the distinctive 152m escarpment which divides the area lengthwise. It is characterised by a large number of small gulches; rain and fog all year round; exceptionally poor vertical drainage; bogs; and deadfall ohia, making this valley one of the most impenetrable and inhospitable areas in the state. Subjected to the north-east trades for 70% of the time, the park climate ranges with altitude from tropical humid to alpine desert with the mean annual rainfall ranging from 250 to 1000mm; the mean temperature ranges from 0°C to 20°C.

VEGETATION At least nine ecosystems are found in the park, ranging from small enclaves of only a few hectares to major expanses on the mountain; each comprises its own unique plant and animal communities. The western slope of

Mount Haleakala above 2,833m, and most of the central and western end of the crater, supports an alpine desert vegetation, including the threatened Haleakala silversword Argroxiphium sandwicense. Across the crater on the ridges above Paliku two native Deschampsia grassland communities occur, they are noteworthy in that one of them represents the highest elevational and least disturbed tussock ecosystem in the state and it is the only grassland of its kind in the U.S. It includes several endemic species, some of which are threatened. Immediately below the Deschampsia grasslands a narrow band of alpine shrub-scrub vegetation acts as a buffer between the open summits and the ohia rainforest. Dominant shrub genera of these upper slopes and crater include Styphelia, Vaccinium, Coprosma and Sophora. The Hana ohia rainforest of the north and east slopes stretches from around 610m up to the trade wind inversion at about 2,074m. Although much of this habitat lies outside the park boundaries, an important segment is found within the north central corner of the park. This area, with its extremely dense rainforests, high rainfall and precipitous gulches, represents one of the most inaccessible and consequently most pristine forests in the state and is the habitat of many rare plants. Below 1,220m the Kipahulu Valley rainforest is characterised by a 'koa' Acacia koa canopy, with tree ferns, ohia, and many other native plants forming the understorey. Kipahulu Valley is one of the richest botanical regions in Hawaii, with genera such as Metrosideros and Cheirodendron. As in the Hana rainforest, this area contains many uncommon plant species. In the 'Waianapanapa' of the Hana rainforest, and to a lesser extent in Kipahulu Valley, there are a number of bogs and several ponds; one of these being one of only two natural lakes in Hawaii. Between this feature and the Deschampsia grasslands is Flattop Bog, at nearly 2,316m the highest altitude bog in Hawaii. These bog areas are believed to contain valuable pollen records. Nearby is critical habitat for the rare greensword Argroxiphium virescens, a relative of the silversword. Of the two species originally found here, one is though to be extinct as a result of early grazing activities. The Kaupo area supports remnant dryland forest of Pleomele and Planchonella. Threatened Santalum haleakalae and Geranium arboreum are found on the north-west slopes.

FAUNA Native fauna are limited to birds, insects and a few aquatic organisms present in the streams of Kipahulu. Threatened birds include Maui akepa Loxops coccinea ochracea (recently sighted for the first time in 30 years), the Hawaiian goose or nene Branta sandvicensis, Maui parrotbill Pseudonestor xanthophrys, crested honeycreeper Palmeria dolei, Maui nukupu'u Hemignathus lucidus affinus, the dark-rumped petrel or uao Pterodroma phaeopygia sandwichensis (limited to small breeding populations on Haleakala and to a much lesser extent on the islands of Hawaii and Lanai) and the po' o uli Melamprosops phaeosoma. Other endemic birds are iiwi Vestiaria coccinea, Maui amakihi Loxops virens wilsoni, apapane Himatione sanguinea, Maui creeper Loxops maculatas newtoni and pueo Asio flammeus sandwichensis. Indigenous birds include the white-tailed tropic bird Phaethon lepturus dorotheae and golden plover Pluvialis dominica fulva. The diverse speciation of the invertibrate fauna represents a highly valuable evolutionary resource. Numerous endemic insects are found, over 20% of them unique to Mount Haleakala. There are many rare Drosophila flies found only in the Paliku area and Kipalulu Valley, including the largest Drosophila in the world and the rare freshwater lizard goby Lentipes concolor. The alpine desert area has flightless forms of 25 insect species. An unusual predatory caterpillar is also found. Common freshwater fauna include the o' opu (a small goby-like fish), opae (a small shrimp) and hihiwai (a freshwater limpet).

ZONING/CONSERVATION MANAGEMENT The park is divided into five management areas, General Outdoor Recreation Area, 280ha; Natural Environment Area,

1,363ha; Outstanding Natural Area, 4,690ha; Primitive Area 4,712ha; and Historical and Cultural Sites, 1ha. It also contains Kipahulu and Crater Historic District, totalling 7,263ha, and the designated Haleakala Wilderness, of 10,028ha; these areas overlap for the most part. Much of the Kipahulu Valley is closed to public entry, access being limited to scientific research and for purposes of resource management. The Kipahulu Coastal Area is not connected by roads to the Haleakala Crater.

STAFF There are 16 permanent and full-time employees and 12-20 seasonal employees.

LOCAL ADMINISTRATION Superintendent, Haleakala National Park, PO Box 369, Makawao, Maui, Hawaii 96768.

VISITOR FACIITIES No information

SCIENTIFIC RESEARCH AND FACILITIES A National Park Service scientist has been resident in the park since 1980. Since 1973, the Cooperative National Park Resource Study Unit (CPSU) at the University of Hawaii has produced numerous technical reports concerning the components of the park's ecosystems; this research is continuing. The University of Washington CPSU has conducted biological studies on two endangered birds, the dark-rumped petrel and the ne-ne. The US Fish and Wildlife Service is analysing data from a survey of endangered birds on Haleakala. Independent research projects are being conducted on several general or endemic plant species including Argyroxiphium, Dubautia and Tetramolopium. Research is oriented towards study of the high degree of endemicity, adaptive radiation genetics and evolutionary trends. There is a small research laboratory facility with office space and an adjoining dormitory for visiting researchers.

MODIFICATION OF THE NATURAL ENVIRONMENT Man and introduced feral goats Capra hircus, pigs Sus scrofa, horses and, in the past, cattle, have had a serious impact on the mountain area, altering the native ecosystems through the destruction of the native biota and accelerated erosion. This has allowed exotic vegetation to establish itself in many areas of the park. Invading species include guava Psidium cattleyanum, kikuyu grass Pennisetum clandestinum, Yorkshire fog Holcus lanatus and Maui pamakani Eupatorium adenophorum. Native fauna have also been affected through predation by such exotic species as rats, mongoose, mice, feral cats and dogs, vespid wasps and Argentine ants. The native Deschampsia grasslands are ravaged by feral pigs and goats but are also heavily used by the ne-ne Branta sandvicensis.

PRINCIPAL REFERENCE MATERIAL

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Isle Royale National Park

BIOGEOGRAPHICAL PROVINCE 1.22.14 (Great Lakes)

LEGAL PROTECTION Total, since 1940

DATE ESTABLISHED Approved in 3 March 1931 as a National Park, November 1980 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION North central portion of Lake Superior, Michigan; 47°48'-48°16'N; 88°15'-89°20'W.

ALTITUDE 184-425m

AREA Total 215,740ha, of which 54,047ha is land.

LAND TENURE Federal government ownership

PHYSICAL FEATURES An archipelago, the park is distinguished by a single large island (Isle Royale) 72km long and 14km at the widest point, with 200 islets projecting off the peninsulas of the main island. The park was mostly formed by Keweenawan lava flows with interbedded sandstones and conglomerates, all of Precambrian age. Subsidence, coincident with the filling of the Keweenaw basin, produced a grossly synclinal landform of from 5-50° southwards. Repeated glaciation and erosion in Pleistocene times, particularly of sedimentary rock between uplifted volcanics, produced the long valleys that alternate with the ridges, which characterise the park. The area was covered by glaciers at four different times in the last million years, the last retreat being between 9,000 and 10,000 years ago. Young, thin and typically organic soils have developed since the subsidence of post glacial lakes. The park's climate is greatly influenced by Lake Superior, which buffers temperatures and increases precipitation and humidity. Summers are moderately moist and cool with approximately 500-600mm rainfall and an average temperature of 12°C. Daily lows in winter are commonly 3.3°C warmer than those on the mainland, with temperatures ranging from 5°C to -50°C, and an average snow accumulation between 70cm and 80cm. An ice bridge frequently forms to connect Isle Royale with Canada.

VEGETATION The island is located in the transition zone between the Canadian biotic and Hudsonian zones, and the vegetation is of the boreal conifer forest type, and northern hardwood forest type. In the cooler and more damp areas near Lake Superior, balsam fir Abies balsamea, white spruce Picea glauca and paper balsam Betula papyrifera dominate the mature forest and comprise almost 30% of the island's vegetative cover. Sugar maple Acer saccharum and yellow birch Betula allegheniensis dominate the warmer and drier sites in the interior of the park and occupy approximately 10% of the cover. Island lakes and bogs contain sedges, bog rosemary Andromeda glaucophylla, labrador tea Ledum groenlandicum, Sphagnum spp., tamarack Larix laricina, black spruce Picea mariana, and others. Fire is an important influence on the vegetative makeup and aspen Populus tremuloides and paper birch Betula papyrifera comprise 56% of the cover. Rocky shorelines contain crustose and fruticose lichens, mosses, low-lying junipers and boreal crevice plants. The island's isolated nature and transitory biotic position make it botanically significant and represent the extreme distribution of several plant species, most noteworthy of which is Devil's Club Oplopanox horridum. Over 680 ferns and flowering plants have been recorded on the island.

FAUNA The wildlife of Isle Royale is one of the most significant resources. Sufficiently isolated from the mainland, the island contains only 16 mammalian species. Extremely noteworthy, in part because of the classic predator/prey studies, are the gray wolf Canis lupus (E), which in 1980 had a population of 50; and the moose Alces alces. There are 197 bird species, including loon Bavia immer, black duck Anas rubripes, meganser Mergus merganser and osprey Pandion haliaetus. Also present are red fox Vulpes fulva, beaver Castor canadensis, snowshoe hare Lepus americanus, and red squirrel Tamiasciurus hudsonicus. The endangered peregrine falcon Falcon peregrinus and bald eagle Haliaeetus leucocephalus, once residents, are now only transitory migrants to the island.

ZONING/CONSERVATION MANAGEMENT Wilderness/natural: 99%; non-wilderness/developed: 1%; historic: negligible. Lake Superior managed as a natural zone: 163,822ha.

STAFF Nineteen permanent full-time employees, 15 permanent part-time employees, augmented seasonally by 60 temporary staff.

LOCAL ADMINISTRATION Superintendent, Isle Royale National Park, US National Park Service, 87 N Ripley St., Houghton, MI 49931.

VISITOR FACILITIES Access to the island is by boat or float-plane for which reservations are always required. There is a lodge and supplies and facilities at Rock Harbour as well as numerous camp sites for which permits are required. There are more than 260km of foot trails on the island. Guided interpretive walks and hikes are conducted round the island.

SCIENTIFIC RESEARCH AND FACILITIES Due to the unspoiled wilderness character and the island's isolation from most external influences, the park's significance as a scientific study unit cannot be over-stressed. The park provides an isolated ecosystem where wildlife populations are largely confined; yet the island is large enough to provide a total working ecological unit. Dr Durwood Allen has stated that "Isle Royale is probably the most ideal outdoor laboratory in the world". Annual wolf/moose research has continued since 1958; vegetative succession and acid rain studies are also being conducted along with six to eight other research projects. There is a research station on the island consisting of an 11 room building, tent platforms and docks. There area also two research camps, two research cabins and logistial support are provided as well as a reference library.

DISTURBANCES, DEFICIENCIES AND MANAGEMENT PROBLEMS Sporadic copper mining took place until 1895 with associated burning to reveal mineral outcroppings. Timber harvest of white pine Pinus strobus and sugar maple Acer saccharum for syrup has occurred, extent unknown but minor. Atmospheric deposition of pollutants threatens park resources. Acid rain, in particular, may be having severe impacts due to the low buffering capabilities of soils. High levels of PCB's have been found in inland lakes.

PRINCIPAL REFERENCE MATERIAL
40-50 publications and research reports on the natural history, including comprehensive works on the classic predator/prey (wolf/moose) studies.

Big Thicket National Preserve

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION Public law 93-439, 11 October 1974. 80% protected, but mineral exploration and extraction and hunting are allowed.

DATE ESTABLISHED Approved in 1974 as a National Preserve; October 1981 as a Biosphere Reserve)

GEOGRAPHICAL LOCATION South-east Texas, bounded by the Neches and Trinity Rivers to the east and west and Woodville and Beaumont to the north and south, 120km north-west of Houston. Centre of area approximately 30°31'N, 94°19'W.

ALTITUDE 0-8m

AREA Naitonal Park: 34,243ha; Biosphere Reserve: given as 34,769ha

LAND TENURE Federal

PHYSICAL FEATURES The southern units are flat, low and poorly drained, while the northern units grade to hilly topography with moderate drainage. Two rivers and several creeks drain the region, but flooding is common throughout the area. Soils are generally clay, or sandy with impermeable hardpan beneath. Geologic formations present are the Beaumont, Montgomery, Bentley, Willis and Fleming. Mean annual temperature is 20.1°C at an altitude of 4.9m; mean annual precipitation 1350mm at the same altitude.

VEGETATION The Big Thicket area is often referred to as a 'biological crossroads' between the most eastern hardwood forest, the arid south-western desert, the tropical coastal marsh and the central prairies. It occupies the westernmost part of the southeastern evergreen forest, also known as the southern mixed hardwood forest or the longleaf-slash pine forest. Part of it extends west into the type termed oak-hickory-pine or loblolly-shortleaf. Overall, the vegetation can be divided into four broad types - uplands, slopes, floodplains and flatlands, each of which is further divided as follows: uplands - sandhill pine forest (53ha), upland pine forest (460ha), wetland savanna (734ha); slopes: upper slope pine-oak forest (4,185ha), mid slope oak-pine forest (1,994ha), lower slope hardwood pine forest (11,947ha); floodplains: hardwood pine forest (1,086ha), floodplain hardwood forest (9,410ha), wetland baygall shrub thicket (1,375ha), swamp cypress tupelo forest (524 ha); and Flatlands: flatland hardwood forest (3,304ha). The Big Thicket is an area of considerable biological diversity, with more than 1,000 species of plants, including four genera of insectivorous plants, over a dozen species of orchids and many fungi.

FAUNA Animals include nearly 300 species of birds (mostly migrants in season), 61 species of mammals, 70 species of reptiles and amphibians, 97 species of fish and a large uncounted number of invertebrates. There are no resident populations of endangered species, but there are peripheral populations of red-cockaded woodpecker Dendrocopos borealis and American alligator Alligator mississippiensis, Texas red wolf Canis rufus, thought to occur presently only as hybrids and ivory-billed woodpecker Campephilus principal (maybe extinct in this area).

ZONING/CONSERVATION MANAGEMENT Most of the preserve has been included in the natural zone and natural environment subzone. The natural zone places

management emphasis on conservation of natural resources and processes while providing for uses that do not adversely affect these resources and processes. The major portion of each preserve unit is included in the natural environment subzone. This subzone will be managed to ensure minimum impact on the natural and ecological integrity of the preserve and to provide for environmentally compatible recreational activities. There is only one strict protected "Research Natural Area, sub-zone" of 91ha in the Beaumont Unit consisting of a regal fern bog area. Access to this area is limited to National Park Service and research personnel.

STAFF A superintendent is assisted by a permanent (including part-time) staff of nine in administrative support, 19 in protection, resource management and interpretation, and eight in maintenance.

LOCAL ADMINISTRATION Big Thicket National Preserve, 8185 Eastex Freeway, Superintendent, PO Box 7408, Beaumont, Texas, 77706.

VISITOR FACILITIES Park rangers act as guides and leaders. A visitor Information Station and Hiking Trails are available.

SCIENTIFIC RESEARCH AND FACILITIES There are numerous research projects being conducted to gather baseline information of flora, fauna, geology, archaeology and history. There are many ongoing monitoring activities, e.g. climate, soils, hydrology, air quality and selected plant communities. There are no scientific facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT The principal disturbances and threats include gas and oil exploration and extraction, population growth and encroachment, and hunting and trapping.

PRINCIPAL REFERENCE MATERIAL

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Guanica Commonwealth State Forest Reserve

BIOGEOGRAPHICAL PROVINCE 8.40.13 (Greater Antillean)

LEGAL PROTECTION Under the provisions of administrative bulletin no. 139 of 22 December 1919, Governor Arthur Yager assigned 2,079ha to create the original Guanica Forest Reserve. In subsequent years more lands were acquired by various means, adding the balance to make up the 4,016ha which today comprises the total area of the reserve. The area is currently managed by the Puerto Rico Forest Service, Department of Natural Resources, under Puerto Rico's forest Law 133 of 1 July 1975. The Secretary of Natural Resources, under authority of Law 23 of June 1972 and Law 70 of May 1976, has the

responsibility of developing hunting regulations as well as protecting and enhancing wildlife in the Commonwealth of Puerto Rico.

DATE ESTABLISHED 22 December 1919 as a forest reserve and October 1981 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Located on the southwestern coast of Puerto Rico, about 30km west of Ponce. 17°55'N, 67°05'W.

ALTITUDE 0-228m

AREA The biosphere reserve covers an area of 4,006ha

LAND TENURE The forest is publicly owned by the Commonwealth of Puerto Rico. The Puerto Rico Land Authority holds title to 942ha, but these are managed by the Department of Natural Resources which owns the remaining land.

PHYSICAL FEATURES Guanica Forest is divided into two segments which are separated by Guanica Bay. The highest elevation, 228m above sea level, occurs at the Criollo-2 triangulation station in the eastern and largest part of the forest. With the exception of steep slopes which surround the eastern segment of the forest and the entrance to Guanica Bay, relief can be described as undulating with moderate slopes generally less than 40%. Relief in the western portion is more gentle than in the eastern portion. Approximately 90% of the forest is underlain by mid-Tertiary sedimentary rocks, predominantly limestones. A layer of secondary calcium carbonate, several metres deep, covers practically all of this limstone. The limestone surfaces in places become virtually the only substrate for plant growth of elevations below 80m. Volcanic and sedimentary rocks of Cretaceous origin account for 9% and beach and alluvial deposits for only 1% of the forest area. Sixteen soil types are found within the forest boundaries, the predominant (82% of the forest) being limestone rock land, El Tuque gravelly. Mean annual precipitation recorded at a nearby station is 791mm with the wettest period occurring during September through November. Mean annual temperature is 25°C with a mean monthly minimum of 23°C in January and a mean monthly maximum of 26°C in September. An absolute maximum of 37.9°C has been recorded during the summer months. Estimates of evaporation utilizing data from nearby stations yielded an annual evaporation rate of 2020mm or more than twice the annual rainfall. Pan evaporation studies within the forest resulted in a similar value of 2074mm. No perennial streams are found in the forest and stream flow is virtually all from rapid surface run-off during stormy periods.

VEGETATION Eight plant associations have been described for the Guanica Forest (Lugo et al., 1978). The upland associations consist of a deciduous forest (2,345.7ha), a semi-evergreen forest (718.2ha) and a scrub forest (581.4ha). The saline and beach associations consist of mangrove (25.9ha), salt flats (9ha) and beach and headland thicket (85.5ha). Human or disturbed associations consist of plantations (31.1ha) and savannas (55.6ha). The more structurally complex forest types are the deciduous and semi-evergreen forests, although transitions from one type to another are gradual. The tallest trees in Guanica are found in the semi-evergreen forest. The most abundant tree species in the deciduous forest are Exostema caribaeum and Pisonia albiia which together account for about 70% of the basal area. Succulent plants, mainly cacti, grow at lower elevations, where exposed limestones become virtually the only substrate for plant growth. The thorn shrub or shrub forest has been described as the most diagnostic formation in the West Indies and one in which endemism may be high. Over 700 species of

plants have been reported for the Guanica Forest. Of these, 246 are trees, 48 are considered rare or endangered and 16 are found within the forest boundaries.

FAUNA Forty of the 111 resident bird species found in Puerto Rico are present in the Guanica Forest. Nine of Puerto Rico's 14 endemic bird species occur here. These are the Puerto Rican lizard cuckoo Saurothera vieilloti, the Puerto Rican emerald hummingbird Chlorostilban maugeus, the Puerto Rican tody Todus mexicanus, the Puerto Rican woodpecker Melanerpes portoricensis, the Puerto Rican flycatcher Myiarchus antillarum, the Puerto Rican vireo Vireo latimeri, the Puerto Rican bullfinch Loxigilla portoricensis, the yellow-shouldered blackbird Agelaius xanthomus and the Puerto Rican whip-poor-will Caprimulgus vociferus nocitherus. The latter two are endangered species. The forest also supports an important herpetofauna that includes such rare and endemic forms as Ameiva wetmori and Anolis cooki. Two specimens of the extremely rare Puerto Rican toad Bufo lemur were taken from the forest in 1975. Two species of bats, Atibeus jamaicensis and Brachyphylla cavernarum occur in a cave located within the forest's boundaries. This cave is the only known habitat on the main island of Puerto Rico for two cave-adapted aquatic invertebrates Typhlata monae and an eyeless Styiomysius shrimp.

CULTURAL HERITAGE A man-made cave of historical value is located near Camp Borinquen in the forest's eastern segment.

ZONING/CONSERVATION MANAGEMENT The Puerto Rico Land Authority holds title to 942ha in the western portion of the forest. This area is presently managed by the Department of Natural Resources as is the remainder of the forest. Special Use permits have been issued for only 34.6ha, a minor portion of the forest, for such purpose as continued use of water tanks, rights of way and residences. A management plan as developed calls for the establishment of a buffer zone around the entire forest, cooperation with the Planning Board in the development of a zoning policy with respect to land use on adjacent private lands, periodic review of Special Use Permits, and their issue only when the use is compatible with long term conservation of the site.

STAFF Scientific Research, Department of Natural Resources: 28 natural resources specialists and 34 technicians plus clerical and support personnel. Forest Service, Department of Natural Resources: five natural resources specialists and two technicians plus a forest ranger and clerical and support personnel. Two forest guards are located on site.

LOCAL ADMINISTRATION Secretary, Department of Natural Resources, P.O. Box 5887, Puerto de Tierra, Puerto Rico 00906.

VISITOR FACILITIES Recreational facilities consisting of several concrete and wood structures, including shelters, picnic tables, fireplaces and sanitary rooms, are located at Cana Gorda, Tamarindo and Jaboncillo beaches.

SCIENTIFIC RESEARCH AND FACILITIES Early scientific work in the Guanica Forest dealt primarily with qualitative descriptions of its vegetation. Later quantitative studies focused on vegetation structure and aspects of vegetation dynamics such as litter fall, litter turnover, productivity, and transpiration. Recent research has been undertaken on successional trends following cutting and herbicide treatments, herbivory rates and leaf properties and also wildlife investigations. The forest has served and continues to serve as a field laboratory for a number of universities.

Ongoing research includes a study of forest structure, productivity, succession (regeneration following cutting and burning) and the potential impacts of local land use trends in adjacent areas on the forest itself. These studies will provide data that will permit comparison with other tropical and subtropical dry forests, and enhance the understanding of tropical forest dynamics in general. Existing facilities at Camp Borinquen provide a permanent base from which research may be coordinated. Modes laboratory space, and housing within the forest. Analytic laboratory facilities are available at the Department of Natural Resources main office in San Juan. Research priorities are being developed through a cooperative agreement between the Department of Natural Resources and the US Forest Service. The forest offers numerous opportunities for environmental training activities and is presently used as an example of Subtropical dry forest, particularly in light of its high plant and avifauna diversity, for various University programmes.

MODIFICATION OF THE NATURAL ENVIRONMENT For the past 50 years the Guanica Forest has been protected from such activities as charcoal cutting, goat grazing and subsistence farming. During the late 1930's and early 1940's the Civilian Conservation Corps built nearly all of the existing buildings, roads and trails. The road and trail system consists of approximately 57km. There are five permanent structures of significant size, including an office building and the forest ranger's residence (see attached table). About 30ha of the forest consists of plantations (mainly Swietenia mahogani). Typically, but not exclusively, the Guanica Forest serves the recreation needs of people living in eight nearby municipalities - a combined population total of over 330,000 people as well as those who travel from other areas of the island. Visitation is greatest in beach areas. In non-coastal areas land uses in adjacent private lands appear to have had little impact upon the forest, however, the necessity for strict control of fire must be recognized.

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California Coast Ranges Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION No information

DATE ESTABLISHED 1983 as a Biosphere Reserve

GEOGRAPHICAL LOCATION The geographic area concerned comprises the southern portion of the Oregonian Biogeographic Province, and is generally defined on the west by the range of the coast redwood Sequoia sempervirens and on the east by a line generally following the eastern limit of the Coast Ranges of northern California and extreme south-western Oregon, and including the southern Suskiyon Mountains, Klamath Mountains, Trinity Mountains, the Snow Mountain region, and other uplands west of the Sacramento Valley. South of San Francisco, the area is restricted to the mountains bordering the Pacific Ocena as far south as the northern portion of the Santa Lucia Range is central Monterry County.

ALTITUDE 0-1,572m

AREA Total area of 62,098ha; the North California Coast Range Preserve Unit covers 3,114ha; the North Coastal Redwood Northern Unit Complex is 43,300ha in area; the Central Unit Complex consists of 5,624ha; the Southern Unit Complex is 10,360ha in area.

LAND TENURE Together the whole Biosphere Reserve brings together protected areas owned and managed by eight different administrators, including three federal agencies, two state agencies, one private conservation organization, the University of California and a private corporation.

PHYSICAL FEATURES See individual sites

VEGETATION The Northern Unit Complex is made up of Redwood National Park plus three other states parks with examples of redwood Sequoia sempervirens forest, second growth redwood forest, successional vegetation and coastal and near-shore communities. The Central Unit Complex consists of three contiguous protected areas which together provide a representative example of the Douglas fir-mixed evergreen forest typical of this central coastal region of California. It contains the largest stand of old growth Douglas fir in California. The Southern Unit Complex consists of one reserve and the western slopes of Cone Peak located within Los Padres National Forest, which have natural stands of redwood at their southernmost limit. Other vegetation types include coastal scrub, chaparral, grassland.

FAUNA See individual sites

ZONING/CONSERVATION MANAGEMENT The Ranges contains four geographical units: Northern Unit Complex, Central Unit Complex, Southern Unit Complex and Eastern Unit Complex.

STAFF See individual sites

LOCAL ADMINISTRATION See individual sites

VISITOR FACILITIES See individual sites

SCIENTIFIC RESEARCH AND FACILITIES All the protected areas making up the biosphere reserve have been extensively studied due to the proximity of excellent University facilities, their status as 'Experimental Forests' and observation/monitoring sites. There is therefore an exceptionally large collection of bibliographical references and data. The potential for comparative studies with other temperate evergreen and mixed forest types is enormous. Environmental education activities vary according to the site but are very well organized.

MODIFICATION OF THE NATURAL ENVIRONMENT In the Northern Unit Complex, the 23,330ha core is undisturbed; the buffer zone has been logged in the past and is being managed to allow natural rehabilitation. In the Central Unit Complex, the core of 1690ha is undisturbed and entirely protected; the buffer zones consist of Bureau of Land Management holdings for which management is limited to the maintenance of existing roads, trails and buildings and the use of prescribed fire to protect and restore the forest vegetation. The Southern Unit Complex consists of a relatively small pristine area within a larger well-protected area and is managed as a wilderness (no human intervention whatsoever) or for observation and monitoring only.

PRINCIPAL REFERENCE MATERIAL
See individual site

California Coast Ranges Biosphere Reserve: Northern California Coast Range Preserve Unit

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION The area is managed as a strict nature reserve and an experimental/scientific reserve.

DATE ESTABLISHED No information

GEOGRAPHICAL LOCATION The preserve is located 40km north-east of Fort Bragg, Mendocino County, California. Though it is only 16km from the Pacific Ocean, a north-south ridge separates the preserve from the influence of marine climate. Located in the Califorina Coast Range mountains the preserve is bisected by the South Fork of the Eel River, which flows north through the region. The preserve can be reached from California Highway 1 or U.S. Highway 101 via the Barnscomb Road (State Highway 52). 39°45'N, 123°58'W.

ALTITUDE 360-1,112m

AREA The preserve covers an area of 3,114ha

LAND TENURE The Coast Range Preserve is cooperatively owned and managed by the Nature Conservancy and the Bureau of Land Management. The Nature Conservancy has fee title to 1,574ha (1959, Heath and Marjorie Angelo, sellers). The Bureau of Land Management owns 1,540ha which were withdrawn from public use and resource extraction during the years from 1961 to 1971. The BLM acreage is presently designated as a Area of Critical Environmental Concern (1981).

PHYSICAL FEATURES These include steep, well-defined ridges and a series of river terraces. Rocks are of a coastal Franciscan formation - highly deformed marine trench sediments, sandstone and shale. Soils are classified as

fine-loamy, mixed, mesic from parent material of sandstone and shale; primarily Hugo and Josephine types. Site bissected by South Fork of Eel River. The preserve lies in an elongated belt of highly deformed marine trench sediments termed the "coastal franciscan". Rocks present in the area are of three types: graywacke (sandstone), shale, and conglomerate. The terrain is characterized by well-defined ridges, commonly exceeding 50%. Exceptions to this rugged landscape are a series of terraces that lie approximately 15km above the present river channel; these alluvial plains suport open meadow vegetation. A special feature of this preserve is the Elder Creek watershed, a National Natural Historical Landmark and undisturbed watershed entirely contained within the boundaries of the preserve. The mean annual temperature in the preserve is 10°C and the mean annual precipitation is 2125mm.

VEGETATION The major cover types of the mid to low elevation, lower Oregonian province are well represented within the boundaries of the reserve. The dominant community here is the extensive forest of coastal old growth douglas fir, the largest of its kind in the state. Unusual species are often associated with the douglas-fir Pseudotsuga menziesii, such as Pityopus californica, Monotropa hypopithys, Juncus effusus and Festuca idahoensis. Associated with the douglas fir in a vegetation patchwork are mixed evergreen forests, small pockets of old growth redwood, oak woodlands, and chaparral. The land use habits of early inhabitants, which included burning, clearing and agriculture have influenced the vegetation patterns present today. Thus an entire spectrum of vegetation communities exists, including virtually all successional stages. The mixed evergreen forest type includes an extremely diverse array of tree species associations. Within the preserve are pure and mixed stands of madrone Arbutus menziesii, tan oak Lithocarpus densiflora, chinquapin Chrysolepis chrysophylla, Canyon live oak Quercus chrysophylla and interior live oak Q. wislizenii, all with and without a douglas fir component. Another community unique to the mid to low elevation Oregonian province, and found on this preserve, is the coast grassland. While not large in total area, these native grasslands, dominated by California oat grass Danthonia californica are represented in seven distinct meadows on this site. The preserve's grasslands are notable for their pristine character; several of the meadows support impressive stands of native perennial bunch grasses. In all, 451 species of vascular plants, 321 species of fungus, 78 species of lichen, 43 species of moss, 36 species of algae and nine species of liverworts are found in the preserve.

FAUNA This includes spotted owl Strix occidentalis, goshawk Accipiter gentilis (at the lowest elevation for nesting in California), pileated woodpecker Dryocopus pileatus, black bear Ursus americanus, mountain lion Felis concolor, river otter Lutra canadensis, northern flying squirrel Glaucomys sabrinus, red backed tree vole Arborimus longicaudus, steelhead Salmo gardneri and salmon Oncorhynchus kisutch. Olympic salamander Rhyacotriton olympicus reaches its southern range extension. In all the preserve contains 63 species of mammals, 118 species of birds, 12 species of reptiles, nine species of amphibians and five species of fish. The Biosphere Reserve nomination form submitted to Unesco contains a list of species found in the reserve.

ZONING/CONSERVATION MANAGEMENT The core of this preserve was essentially designed around the Elder Creek, Fox Creek, Barnwell Creek and Skunk Creek watersheds. The core area boundaries run along the tops of two north-south ridges. The Elder Creek watershed, undisturbed and entirely protected, occupies 1,560ha in the heart of the preserve. Human use of the area is

concentrated in three areas: the headquarters (16ha), Wilderness Lodge (2ha), and the Angelo Homestead (5ha). permitted activities include scientific research, nature study, educational group use, passive recreation; prohibited activities include resource extraction, hunting, fishing, vehicle use, resource manipulation. In addition to the BLM lands within the preserve, buffer zones are created by BLM holdings on the east and west boundaries of the preserve. The management plan for the Coast Range Preserve is based primarily on protection of critical elements: the spotted owl, the old growth Douglas-fir forests, and the low elevation native grasslands. The five year plan 1981-1985 involved active management projects which aim to restore and protect the preserve's resources. A prescribed burn plan to 1) reduce the hazard of catastrophic fire into the ecosystem, is planned. Restoration of native grasses, removal of introduced plants and feral pig control are other goals.

STAFF The preserve has two full time staff.

LOCAL ADMINISTRATION The Managers, Northern California Coast Ranges Preserve, 42101 Wilderness Road, Branscomb, CA 95417.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES There has been a strong history of research on this preserve, including studies of human land use history, meadow succession, spotted owl ecology and complete inventories of the geology, flora and fauna. Current research on the preserve includes work on old growth forest bird communities, the tree species soil affinities, forest succession, beetle ecology, the resiliency of watersheds to logging disturbance, spotted owl breeding ecology and native grassland enhancement. The continuous monitoring of air temperature, precipitation, the Elder Creek benchmark hydrologic station, several permanent forest monitoring plots and basic floral and faunal inventories all provide the baseline data to facilitate research on this preserve. The potential for additional research on the ecosystems in this area is great, for the old growth douglas-fir forest, though heavily manipulated elsewhere, is little studied. In the buffer areas, planned timber harvests could be incorporated in manipulative research involving resource management questions. These buffer areas are immediately adjacent to the core area of the preserve and as such are accessible for research purposes. The pristine character of the core area presents an ideal situation for comparative studies. There is a field station in the preserve as well as one all-weather lodge which can accommodate four to six scientists.

LOCAL POPULATION Present human settlements in the preserve include the headquarters (two residents) and the founder's home (one resident).

MODIFICATION OF THE NATURAL ENVIRONMENT A single road enters the preserve and access is controlled by the preserve managers at the entry point. This feature helps to ensure the protection of the site itself and also provides protection for instruments, equipment and markers relating to research on the preserve. Because of the isolated nature of the preserve, threats to its integrity from land uses on adjacent lands are virtually nonexistent. Human activities on this site have been minimal and were restricted to a few homesteading attempts near the turn of the century. The most notable impact by humans has been in the use of fire. Native americans and early homesteaders burned large areas of the preserve fairly regularly. Since the homesteading era, fire has been excluded from the preserve. There is a management programme currently underway to reintroduce fire, in a limited

manner, via prescribed burning. Relative to the region as a whole the core area is in nearly pristine condition. Small portions of the core and the buffer areas have been logged and areas of the buffer zone have been proposed for timber harvest. These sites are well-suited for research on, before and after manipulation conditions. The Elder Creek watershed is undisturbed and recognised by the National Park Service as a National Natural History Landmark and by the US Geological Survey as a Hydrologic Benchmark, thus giving the preserve national significance.

PRINCIPAL REFERENCE MATERIAL

Barrows, C.W. (1980). Feeding ecology of the Spotted Owl in California. Raptor Research 14(3): 73-78.

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Gaines, D. and Gaines, S.J. (1980). Checklist of the Birds of the Northern California Coast Range Preserve

Grover, A. and Larsen c. (1979). NCCRP Mammal Species List.

Patterson, C. (1977). Vascular Plant Species of NCCRP.

California Coast Ranges Biosphere Reserve: North Coastal Redwood Northern Unit Complex of California

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION PL 90-545, 1968 Redwood National Park, Act of Establishment; PL 95-250, 1978 Amendment to Expand Redwood National Park; Forest and Rangeland Renewable Resources Research Act of 1978, Public Law 95-307, 16 USC 1600; Administrative Regulations of US Department of Agriculture 9AR 300 B, C and Reg UF of regulations of Secretary of Agriculture; California Resource Code Sec. 5001 and 5002, statutes adopted 1939.

DATE ESTABLISHED Declared a World Heritage Site in 1980; accepted in 1983 as a Biosphere Reserve

GEOGRAPHICAL LOCATION The North Coastal Redwood unit of the California Coast Ranges Biosphere Reserve is located in Humboldt and Del Norte Counties, California. The reserve lies between Crescent City and Orick, California, about 500km north of San Francisco. It occupies the coastal margin of the coast range and includes 56km of largely undeveloped Pacific Ocean coastline. The Klamath and Smith Rivers and Redwood Creek rise in the coast range and flow through the reserve. The Redwood Experimental Forest is located 1km east of the parklands at Klamath, California. 41°30'N; 124°00'W.

ALTITUDE 0-950m

AREA The reserve covers an area of 43,300ha, with core zone of 23,300ha.

LAND TENURE US National Park Service owns Redwood National Park (31,570ha); California Department of Parks and Recreation owns Jedediah Smith Redwood State Park (3,720ha), Del Norte Coast Redwood State Park (2,580ha), Prairie Creek Coast Redwood State Park (5,050ha); US Forest Service, Pacific Southwest forest and Range Experiment Station owns Redwood Experimental Forest (380ha).

PHYSICAL FEATURES The reserve has two distinctive physiographic environments - the coastline and the mountains of the Coast Range. The coastline includes rocky cliffs broken by rolling slopes with sand or pebble beaches. Inland is

the dominating physiography of the Coast Range. Major streams and ridgelines trend northwest. The gently rounded summits of the mountains contrast with the steep sideslopes that have been deeply incised by streams. The bedrock is primarily a collection of sandstones, siltstones, and minor amounts of conglomerates. There also are isolated exposures of chert and volcanics. The Franciscan is bounded on the west by the San Andreas fault. At 50m, mean annual temperature is 10.5°C and mean annual precipitation is 2120mm.

VEGETATION The principal vegetation type is redwood forest (16,100ha) with 20,700ha of second growth redwood forest or successional vegetation. Other types, after Munz and Keck (1959) include northern coastal scrub, coastal prairie, coastal strand, freshwater marsh, north coastal coniferous forest, mixed evergreen forest, northern oak woodland, and chaparral. A Serpentine-pine savanna also occurs in a limited area while a marine and intertidal community is found along the 50km coast line of the reserve.

FAUNA Animals of the upland forest and prairie include elk Cervus elaphus, black bear Ursus americanus, grey fox Canis cinereoargenteus, mountain lion Felis concolor, bobcat Felis rufus and others. The freshwater stream fauna include trout, salmon, various amphibians, beaver Castor canadensis and river otter Lutra canadensis. The marine and intertidal zone includes species-rich protected rocky intertidal areas and species-poor sand beaches and sealions Zalophus californianus. The avifauna includes approximately 300 species, a large component of which is seasonal or migratory. A list of mammals and birds of Redwood National Park, compiled by G.S. Lester, is contained within the nomination for Biosphere Reserve status submitted to Unesco.

ZONING/CONSERVATION MANAGEMENT The reserve includes Redwood National Park, Jedediah Smith Redwood State Park, Del Norte Coast Redwood State Park, Prairie Creek Coast, Redwood State Park and Redwood Experimental Forest. The core area is considered to be those lands which are uncut or otherwise generally undisturbed; including the Research Natural Areas. Recently logged lands (about 20,000ha) are considered buffer lands and are subject to manipulation for rehabilitation purposes. The Experimental Forest lands except the Redwood National Area are also classed as buffer. Natural and cultural resource management plans and a watershed rehabilitation plan have been developed for National Park Service lands. Management policies for N.P.S. lands and research natural areas within the resrve are consistent with N.P.S. policies for natural areas of the National Park System. A general plan for the California State Parks was completed in 1983.

STAFF Total staff of 200

LOCAL ADMINISTRATION Redwood National Park, 1111 Second Street, Crescent City, California 95531; California Department of Parks and Recreation, (Northern Region Office), 3033 Cleveland Avenue, Suite 110, Santa Rosa, California 95401, USA; Directory, Pacific Southwest Forest and Range Experiment Station, 1960 Addison Street, Berkeley, California 94701, USA.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Two research natural areas have been established, the 900ha Little Lost Man Creek Redwood Natural Area which is a largely unmodified watershed and the Yurok Research Natural Area in the Redwood Experimental Forest (60ha). Extensive research has been conducted in timber harvest and related topics in the Redwood (formerly Yurok) Experimental Forest by the US Forest Service, Redwood Research Laboratory. Extensive

research in vegetation processes, watershed rehabilitation, hydrology and geology, elk ecology and other topics has been carried out in Redwood National Park and the California State Parks. On-going research and resource management programmes based in the Orick and Klamath areas provide staging facilities for cooperative research and independent research is welcomed. Extensive climatic, hydrologic, vegetation and wildlife monitoring programmes are presently underway in conjunction with watershed rehabilitation programmes and other resource management and research programmes of the three managing agencies. There are several field stations and a number of accommodation sites available within the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Extensive areas (about 20,250ha) of timber were harvested in the recent past. Highways, roads and other developments including campgrounds, residences and limited administrative facilities, are located within the reserve. The grizzly bear Ursus arctos and California condor Gymnogyps californianus are extirpated. The upland old growth forest lands remain the least influenced by modern human alteration and extensive contiguous areas of old growth exist. Prior timber harvest on lands now included in the reserve resulted in accelerated erosion, loss or modification of riparian and aquatic habitat, especially anadromous fish spawning and rearing areas and loss of upland old growth forest habitat. Watershed rehabilitation work is in progress to ameliorate these modern human impacts. Additional timber harvest may continue in portions of the Redwood Experimental Forest and on private land adjacent or upstream from parklands.

PRINCIPAL REFERENCE MATERIAL

Boe, K.N. (1960). Research at the Redwood Experimental Forest. USFS-USDA.

Boyd, M.J. and DeMartini, J.D. (1977). The intertidal and subtidal biota of Redwood National Park. USDI.

Leydet, F. (1969). The last redwood and the parkland of Redwood Creek. Sierra Club.

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California Coast Ranges Biosphere Reserve: Southern Unit Complex: Landels-Hill Big Creek Reserve and Western Slopes of Cone Peak

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION The Ventana Wilderness within the Los Padres National Forest is established by Public Law 91-58 approved by Congress 18 August 1969. The Cone Peak Gradient Research Natural Area within the Ventana Wilderness was approved by the Chief of the Forest Service. The Landels-Hill Big Creek Reserve, a unit of the University of California's Natural Land and Water Reserves System was established by the Board of Regents in 1977.

DATE ESTABLISHED 1983, as a Biosphere Reserve

GEOGRAPHICAL LOCATION 80km south of Monterey City. Approximately 36°N, 119°20'W.

ALTITUDE 0-1,572m

AREA The Biosphere Reserve covers an area of 10,360ha with the entire reserve designated as a core zone.

LAND TENURE Country (US Forest Service) and state (University of California). About 6,475ha area on the national forest and 1,552ha are owned by the University. About 1,295ha are being used by the University by special agreement with the private owners. The remaining 1,036ha are private land.

PHYSICAL FEATURES There are two major basement complexes. One is the Franciscan (Mesozoic) formation and the other is the Salinian complex of granitic rocks and crystalline schists, marbles and injection gneisses (Paleozoic?, possible Carboniferous age). These are separated by a fault possibly marking a Mesozoic subduction zone along the North American plate. There are 17 difference soil type complexes. Mean annual temperature is 13.3°C and annual precipitation 889-1397mm.

VEGETATION There are introduced stands of commercial conifer species (ponderosa pine Pinus ponderosa, sugar pine Pinus lambertiana, jeffrey pine) disjunct from their normal range. Many endemics including Abies bracteata and Arctostaphylos hooveri, restricted to this site. Many northern plants occur at their southern limit and southern plants at their northern limit. One plant, Yucca whipplei, has desert affinities. Also, found are coastal bluff scrub, chaparral, grassland, riparian woodland, mixed evergreen woodland.

FAUNA The fauna is representative of the Central California Coast. Of special interest is the presence of sea otter Enhydra lutris and harbor seal Phoca vitulina. 15 species of reptiles and two species of amphibians are documented on the University reserve. The discovery of California side-blotched lizard Uta stansburiana hesperis is a significant range extension. Geological history has made this area an important zoographical corridor for the dispersal of reptiles and amphibians between northern and southern California. 101 species of birds, in 31 families, have been sighted on or adjacent to the site. 36 species are known to breed. Present are goshawk Accipiter gentilis, spotted owl Strix occidentalis and tlack swift Cypseloides niger. There are 51 species of mammals.

ZONING/CONSERVATION MANAGEMENT The entire area of the biosphere reserve is strictly protected and managed either as legislative wilderness (as part of the Forest Service's Wilderness Area) or for monitoring and observation of undisturbed ecosystems. It is appropriately considered a core area. The remainder of the Ventana Wilderness east of the hydrographic divide, although not included within the biosphere reserve, provides increased protection. At present there is no management plan for the area. The Forest Service is preparing a management plan for the Ventana Wilderness. The University is gathering informaton in preparation for developing a management plan for the lands under its management.

STAFF There are no permanent staff

LOCAL ADMINISTRATION University of California, Systemwide Administration, Berkeley, California 94720.

VISITOR FACILITIES There are some trails and campgrounds and an abandoned road.

SCIENTIFIC RESEARCH AND FACILITIES This has been an important botanical collecting site since the 1830's and there are several type localities. The University research reserve is attracting research not only in terrestrial ecology but also freshwater, intertidal and subtidal ecology. The soon-to-be established Forest Service reserve will be an additional attraction to researchers. The only environmental monitoring activity presently on the reserve is a precipitation station serving the California meteorological flood forecasting computer system. Data are automatically transmitted to a central computer. There is accommodation for three-five long-term researchers and camping for class-sized groups. Administrative/lodging facilities are being upgraded.

LOCAL POPULATION There are some small enclaves of single family dwellings within the reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Except for grazing and some logging in the 1930's and 1940's there is very little significant disturbance in recent times.

PRINCIPAL REFERENCE MATERIAL

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Griffin, J.R. (1976). Ecological Survey of South Fork Devils Canyon Candidate Research Natural Area, Monterey District, Los Padres National Forest. Unpublished paper submitted to the Pacific Southwest Forest and Range Exp Sta.

Howard, D.M. (1973). The gamroa site (Mnt-480) - An Esslen village, with a review of Esselen ethnography. Monterey County Archeological Society Quarterly III, 1, Oct 1973.

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Kennedy, J.A. (ed)(1980). University of California Natural Land and Water Reserves System. Booklet published by University of California Systemwide office of the Natural Land and Water Reserves System.

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USDA Forest Service, Los Padres National Forest (1977). Big Sur Coastal Planning Unit, Final Environmental Statement.

USDA Forest Service, Los Padres National Forest (1978). Land Management Plan, Big Sur Planning Unit.
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California Coast Ranges Biosphere Reserve: Central Unit Complex: The Northern California Coast Range Preserve, The Northern California Coast Range Preserve Research Natural Area, and Elkhorn Ridge/Brush Mountain

BIOGEOGRAPHICAL PROVINCE 1.02.02 (Oregonian)

LEGAL PROTECTION The Coast Range Preserve is cooperatively owned and managed by the Nature Conservancy and the Bureau of Land Management. The Nature Conservancy owns 1,568ha; the Bureau of Land Management owns 1,360ha which were withdrawn from all forms of appropriation during the years from 1961 and 1971. This BLM acreage is presently designated as an Area of Critical Environmental Concern and Research Natural Area (Federal Register, Vol 47, No. 136. Thursday July 15, 1982) Additional BLM acreage, totalling 2,696ha, is included as a buffer zone for manipulative research purposes. The latter acreage is in the Elkhorn Ridge and Brush Mountain planning units.

DATE ESTABLISHED 1983, as a Biosphere Reserve

GEOGRAPHICAL LOCATION The Preserve is located 40km north-east of Fort Bragg, Mendocino County, California, near the town of Branscomb. 39°43'N, 123°38'W.

ALTITUDE 360-1,113m

AREA The preserve covers an area of 5,624ha, with a core zone of 2,928ha

LAND TENURE The Coast Range Preserve is cooperatively owned and managed by the Nature Conservancy (1,568ha) and the Bureau of Land Management, U.S. Department of the Interior (4,056ha, 1360 in core zone and 2,696ha in buffer zone).

PHYSICAL FEATURES The preserve lies in an elongated belt of highly deformed upper Mesozoic and lower Cenozoic marine trench sediments of the Franciscan formation. Rocks present in the area are of three types: graywacke, shale and conglomerate; ultramatics are present in outcrop and one small limestone outcrop has been located. The terrain is characterized by well defined ridges, commonly exceeding 50% slope. Exceptions to this rugged landscape are a series of terraces above the present river channel; these plains support meadow vegetation. The preserve is bisected by the South Fork of the Eel River, which flows north through the region. Black Oak Mountain, at 1,113m, is the highest point on the preserve. Though it is only 16 air kilometers from the Pacific Ocean, a north-south ridge of 818m. separates the preserve from the influences of marine climate. At 360m, the mean annual temperature is 10°C and the mean annual precipitation of 2125mm.

VEGETATION The dominant vegetation type is the douglas-fir/mixed evergreen forest, including the largest stand of coastal old growth douglas fir in California. Representative species include Pseudotsuga menziesii, Lithocarpus densiflora, Arbutus menziesii. Also within the boundaries are virgin Sequoia sempervirens forest, Quercus kelloggii woodland, and chaparral (Arctostaphylos spp, Ceanothus spp, Adenostoma fasciculatum). Significant stands of native grasses Danthonia californica, Festuca idahoensis, Elymus glauca form

low-elevation prairies. The preserve includes many communities typical of the Oregonian province. 451 vascular plants; 321 fungi, 78 lichens, 43 mosses, 36 algae, nine liverworts.

FAUNA The preserve provides important habitat for several unusual wildlife species which are typically associated with old growth forests. Several pairs of spotted owls Strix occidentalis nest on the preserve. Pileated woodpeckers Dryocopus pileatus and red tree voles Arborimus longicaudus are common. River otter Lutra canadensis, mountain lion Felis concolor and black bear Ursus americanus are among the large mammal species. The Olympic salamander Rhyacotriton olympicus finds the southern extension of its range here. Steelhead Salmo gardneri and salmon Oncorhyncus kisutch spawn in the streams. 118 avian species, 63 mammal species, nine amphibians, 12 reptiles, five fish.

ZONING/CONSERVATION MANAGEMENT Within the core zone, the Elder Creek Watershed, undisturbed and entirely protected, occupies 1,690ha in the heart of the preserve. Several smaller watersheds are also within the core area. In addition to the primary purpose of preservation, research and educational uses are encouraged on the preserve. Human activity is concentrated in three areas: the headquarters (16ha), the Angelo Homestead (5ha) and Wilderness Lodge (2ha). Prohibited activities include timber harvest, grazing, hunting, fishing, and off-road vehicle use. Buffer zones are created by BLM holdings in the Elkhorn Ridge and Brush Mountain areas (1,544ha and 1,152ha, respectively). These areas would be well suited to manipulative research. The management plan for the Coast Range Preserve is based primarily on protection of critical elements: the old growth Douglas-fir forests, the low elevation native grasslands, and the spotted owl. The five year plan for 1981-1985 involved active management projects which aimed to protect and restore the preserve's resources. A prescribed burn plan to 1) reduce the hazard of catastrophic fire, and 2) reintroduce fire into the ecosystem, is underway. Removal of introduced plants and restoration of native grasses is another priority. Under the BLMACEC designation, watershed rehabilitation in Barnwell Creek is being undertaken.

STAFF Two full-time preserve managers

LOCAL ADMINISTRATION Northern California Coast Range Preserve, 42101 Wilderness Road, Branscomb, California 95417.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Baseline inventories have been completed on the geology, flora, birds, mammals, reptiles and amphibians and the human land use history. Detailed studies have been completed on spotted owl habitat and feeding ecology and on meadow succession. On-going research includes a study of spotted owl breeding biology, a comparison of bird communities in old growth and disturbed douglas-fir forests, and old growth forest dynamics. Future research will be aimed at understanding the successional patterns, nutrient flows, fire relationships, and wildlife populations in old growth douglas-fir forests; management related questions will be stressed. The heavily manipulated status of virtually all other significant stands of this kind make this preserve an important site for research on this ecosystem. Current research includes: 12 permanent forest study plots; five permanent plots to monitor native grass populations; four permanent breeding bird census plots; bird banding program; 20 photopoint monitoring stations in diverse habitats; US Geological Survey operates a Hydrologic Benchmark Station on Elder Creek monitoring streamflow, acidity, sediments, temperature; two

weather stations monitor temperature, humidity and precipitation. One research station, 21 experimental plots, two climatic stations, one accommodation lodge with six-eight person capacity. Wilderness Lodge houses upto 30 people.

MODIFICATION OF THE NATURAL ENVIRONMENT Homesteaders living on the preserve lands at the turn of the century burned and cleared meadow areas for agriculture and grazing. Logging occurred during the 1950's on 137ha; the remaining lands have never been logged. Present human settlements include the headquarters (two residents) and the founder's home (one resident). Modification at the present is limited to maintenance of existing roads, trails and buildings, and management activities related to restoration and protection.

PRINCIPAL REFERENCE MATERIAL

Barrows, C.W. (1980). Feeding ecology of the spotted owl in California. Raptor Research 14(3): 73-8.

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Patterson, C. (1977). Vascular Plant Species List for NCCRP.

Central Gulf Coastal Plain Biosphere Reserve: Lower Apalachicola River Basin Unit

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION NOAA - Office of Coastal Zone Management and State of Florida matching funds purchased land. Deed reverted wholly to the state or was sovereign lands. September 1979.

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1983

GEOGRAPHICAL LOCATION Lies on the coast of the north-western part of the Florida peninsula. It includes approximately 32km of Apalachicola River floodplain, Apalachicola Bay and some of the barrier islands. Apalachicola, Florida is the nearest town. 29°44'N, 84°58'W.

ALTITUDE 0.1-5m

AREA 72,964ha. Additional lands are currently being negotiated to enlarge the whole reserve. Core zone not yet delineated, but will exceed 90% of area.

LAND TENURE State of Florida

PHYSICAL FEATURES The site includes approximately 32km of Apalachicola River floodplain, the Apalachicola Bay and some of the barrier islands. There are the typical estuarine/coastal formations of river channel, slough, backwaters and swamps with flatwoods and extensive swamps on either side, all with the vegetation cover typical of such habitats. The floodplain consists of

Holocene sediments directly on Miocene strate. The mean annual temperature is 20.3°C and the mean annual precipitation is 1408mm (recorded at an altitude of 5.8m).

VEGETATION Sloughs and ox-bows - bald cypress Taxodium distichum and water tupelo Nyssa sp.; low terraces - overcup oak Quercus sp., water hickory Carya sp., sweet gum Liquidambar styraciflua, ash Fraxinus spp., etc; river banks - river birch Betula nigra, ogeechee-tupelo Nyssa sp. and alder Alnus sp.; sand bars - black willow Salix sp., cottonwood and sycamore; fresh-water marsh occurs between river-edge and swamp. The river bottom grades into tidal marsh in the southern and south-eastern parts of the tract near East Bay. Bay - submerged grasses, mainly Halodule; barrier islands - dune grasses, marshes (fresh and salt), oak-palm hammocks, sand and slash pine. The Biosphere Reserve nomination submitted to Unesco contains a list of vegetation types contained in the reserve, in more detail.

FAUNA Faunistic species diversity is particularly high and this site is noted for having the highest species diversity of amphibians and reptiles in North America north of Mexico, including ten considered rare, threatened or endangered and many endemics. Important bird habitat-species list in excess of 250, including 25 rare, threatened, or endangered. It was the last hold-out of the ivory-billed woodpecker Campephilus principalis. 23 species of rare, threatened, endangered, or endemic molluscs in the basin. 116 species of fresh-water fish, including Atlantic sturgeon. Rare, threatened, or endangered mammals include: Mountain lion Felis concolor, black bear Ursus americanus, Florida and South-eastern weasel Mustela frenata, Florida and Southern mink M. vision and several species of bat. The Biosphere Reserve nomination submitted to Unesco contains a list of species found in the reserve.

ZONING/CONSERVATION MANAGEMENT The elongated shape of the tract, plus the fact that it is bissected by a large public waterway make division into core and buffer uncertain. Management follows Florida Game and Fresh Water Fish Commission guidelines for recreation, wildife management and conservation of unique and irreplaceable lands. Specific policy for uplands is aimed at maintaining ecological integrity and to ensure long-term protection for research and education. Guidelines follow Chapter 259, F.S. (appendix 5) governing Environmentally Endangered lands. The Bay is managed for resource protection, recreation, and commercial fishing. Barrier Islands are managed as a state reserve and state park. The whole area will be managed for hunting, fishing and other recreation.

STAFF The reserve has a total staff of seven

LOCAL ADMINISTRATION Florida Department of Natural Resources,13900 Commonwealth Boulevard, Tallahassee, Florida 32303.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Substantial research has already been carried out by Florida State University and Tall Timbers Research Station and a substantial amount of data has been amassed. Many natural features/phenomena are being monitored (eg vegetation, animal populations, pollution). There is good potential for comparative studies especially for river/estuary interaction and local endemism. Climatological parameters are monitored. Ongoing biological and physicochemical studies, 11 years' continuous data. Commercial seafood species monitored. Sportfish species monitored. Research facilities are excellent. A sanctuary complex,

consisting of offices, laboratories and accommodation, will be available in the near future. There are currently two research stations, three field stations, four experimental plots, one climatic station and accommodation for 20 scientists.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the area consists of undisturbed swamp hardwood forest and the bay islands. The main human activity is tourism/recreation which is being carefully controlled to maintain the ecological integrity of the whole site. Most of the area is largely undisturbed swamp hardwood forest, but logging, diking, draining occur nearby. Some timber-removal (high-grading) doubtless occurred in the past. The western boundary area is most disturbed and thus might serve as a buffer or experimental zone. Some effects of river traffic upon bank and sand bar vegetation are likely to continue. The only industry is commercial seafood.

PRINCIPAL REFERENCE MATERIAL
None listed

South Atlantic Coastal Plain Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.05.05/1.06.05 (Eastern Forest and Austroriparian)

LEGAL PROTECTION See individual sites

DATE ESTABLISHED Accepted as a Biosphere Reserve 1983

GEOGRAPHICAL LOCATION The reserve consists of two separate units, located in the states of New Jersey and South Carolina on the east coast of the United States.

ALTITUDE See individual sites

AREA The Biosphere Reserve covers an area of 444,335ha. The Pinelands National Reserve Unit has 438,210ha, of which 148,928ha has been zoned as a "preservation area" acting as a core zone; the Congaree Swamp National Monument Unit forms a complementary part of the core with 6,125ha.

LAND TENURE See individual sites

PHYSICAL FEATURES See individual sites

VEGETATION The two units of this reserve represent a range of natural ecosystems which are typical of this vast coastal region of the eastern United States, characterised by a gently undulating to flat coastal plain covered with salt marsh, white cedar swamp, sphagnum and cranberry bogs and almost virgin southern bottomlands hardwood forest (the latter at the Congaree Swamp National Monument Unit).

FAUNA See individual sites

CULTURAL HERITAGE See individual sites

ZONING/CONSERVATION MANAGEMENT See individual sites

STAFF See individual sites

LOCAL ADMINISTRATION See individual sites

VISITOR FACILITIES See individual sites

SCIENTIFIC RESEARCH AND FACILITIES Applied and basic research has been undertaken by various institutions such as Rutgers Marine Field Station. All monitoring and research activities are coordinated under the Rutgers Division of Pinelands Research. The reserve as a whole offers excellent opportunities for comparative studies with other coastal lowland temperate forest types. This reserve is also of particular importance for its potential as an open-air laboratory and for environmental education. There are very few good research facilities in the Biosphere Reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT The Congaree Swamp National Monument has been relatively little affected by human intervention apart from some limited road clearing and tree cutting in the 1970's. The greater part of the Pinelands National Reserve is in the natural state although some land is used for local fruit (cranberry) production and several highways interconnect small settlements within the buffer zone.

PRINCIPAL REFERENCE MATERIAL
None listed

South Atlantic Coastal Plain Biosphere Reserve: Congaree Swamp National Monument Unit

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION Public Law 94-545, 18 October 1976

DATE ESTABLISHED 1983 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Congaree Swamp is located 20km south-east of the city of Columbia in Richland County, South Carolina. The southern park border is the Congaree River. 33°45'N, 80°47'W.

ALTITUDE 26.4-36.6m

AREA 6,125ha

LAND TENURE Federal government

PHYSICAL FEATURES The park area is located on the Congaree River floodplain which is a part of the south-eastern coastal plain, a wedge of sediment thickening in a seaward direction. The Quaternary alluvium, which is composed of soils from the Congaree-Tawcaw-Chastain soil association, is predominantly silty and clayey alluvial sediments overlying the marine sediment of the coastal terraces. These soils are deep, nearly level, and well to poorly drained. Flooding occurs an average of 10 times per year. The area is gently sloping. Special features are the unique habitat types related to old, abandoned river channels which are common in the Congaree Monument area. At 30.5m, a mean annual temperature of 17.5°C and a mean annual precipitation of 1,167.5mm are recorded.

VEGETATION Congaree has been called the last significant near-virgin southern bottomlands hardwood forest in the eastern USA. Arboreal vegetation dominates the floodplain with more than 45 tree species. The most common are sweet gum Liquidambar styraciflua, bald cypress Taxodium distichum, water tupelo Nyssa aquatica, loblolly pine Pinus taeda, laurel oak Quercus laurifolia, overcup oak Quercus lyrata, cherry bark oak Quercus falcata var pagodaefolia, American elm Ulmus americana and green ash Fraxinus pennsylvanica. A complete list of species recorded in the Park is contained in the BR nomination sent to Unesco.

FAUNA Endangered species include red-cockaded woodpecker Dendrocopus borealis, American alligator Alligator mississippiensis and bald eagle Haliaaetus leucocephatus. A complete list of species recorded in the Park is contained in the Biosphere Reserve nomination sent to Unesco.

ZONING/CONSERVATION MANAGEMENT The bulk of the park's 6,125ha has been zoned as a natural zone. Approximately 460ha have been set aside and zoned as development areas, a protected natural area sub-zone and an environmental study area. Planned permitted activities will include fishing, canoeing, hiking, back-packing and primitive camping. Prohibited activities will be hunting and destruction of species and habitat. A management plan is currently being devised.

STAFF The reserve has a total staff of four

LOCAL ADMINISTRATION Congaree Swamp National Monument, PO Box 11938, Colombia, South Carolina 29211.

VISITOR FACILTIES No information

SCIENTIFIC RESEARCH AND FACILITIES Over 30 scientific research papers have been completed and several more are currently under way. The potential role of the area in an international research program would be associated with the ecosystem as it relates to a floodplain containing a climatic southern hardwood forest. Three aquatic monitoring stations on Cedar Creek (which bisects the park) collect data continuously and there are two river stations. The endangered red-cockaded woodpecker site is being monitored with bi-weekly spot checks and the record-sized trees are being spot-checked on a semi-annual basis. A climatic station is monitoring acid rain and atmospheric particulates. There is also more general research on climate, vegetation, hydrology and animal populations. The Cedar Creek Hunt Club cabin may be available for research. There are six field stations, two experimental plots, eight experimental wells, a climatic station and accommodation for tnree scientists.

LOCAL POPULATION There are no human settlements.

MODIFICATION OF THE NATURAL ENVIRONMENT Artificial modifications to the property have been limited to several hunt club buildings and 32km of jeep trails. Several tracts, totalling 1,618ha, were clear-cut and selective-cut by lumbermen during the 1970's. Several ancient earthen mounds exist within the park boundary. There are no human settlements. Currently, human activities include hunting, fishing, research and tour-guiding. Tourism/recreation is the major land use.

PRINCIPAL REFERENCE MATERIAL

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Michie, J.L. An Archeological Survey of Congaree Swamp: Cultural Resources Inventory and Assessment of a Bottomland Environment in Central SC. USC Research manuscript series 163. Published by Univ of SC.

South Atlantic Coastal Plain Biosphere Reserve: Pinelands National Reserve Unit

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern Forest)

LEGAL PROTECTION Decrees protecting the area: Coastal Area Facility Review Act September 1973; Pinelands Environmental Council 1975; National Park and Recreation Act 1978; Government Byrne executive order #71 February 1979; NJ Legislature Pinelands Protection Act June 1979.

DATE ESTABLISHED Accepted as a Biosphere Reserve in 1983

GEOGRAPHICAL LOCATION Included in the Pinelands National Reserve are 11 major drainage basins including the Mullica and tributaries (Bass, Wading, Batsto and Oswego Rivers), Great Egg Harbor River, Forked River, Toms River, Rancocas Creek etc. Most Rivers flow into Atlantic barrier bays or Delaware Bay except for Rancocas which flows into Delaware River. 39°45'N; 74°45'W.

ALTITUDE 0-100m

AREA The reserve covers an area of 438,210ha, with a core zone (preservation area) of 148,928ha.

LAND TENURE State wildlife areas - 6,062ha; state forests and parks - 45,400ha; county park - 6.8ha; federal wildlife refuge (Brigantine) - 8,097ha.

PHYSICAL FEATURES The Reserve is located on the Atlantic Outer Coastal Plain and is characterized by gently rolling landscape. The substrate consists of unconsolidated sands, clays and marls which form a podzol soil. The area has not been glaciated and there is no bedrock at or near the surface. The area contains the largest freshwater aquifer in the mid-Atlantic region. The mean winter temperature is 0-2°C; summer temperature 22-24°C. The mean annual precipitation is 1124mm.

VEGETATION The total Pine Barrens flora has over 800 species of vascular plants, of which 580 are native, 270 introduced, five endemic and 71 endangered, threatened or undetermined. Habitat types seen include salt marsh, white cedar swamp, sphagnum bogs, cranberry bogs, upland pine-oak, pygmy pine plains and hardwood swamp. There is a species list available for the reserve.

FAUNA Thirty-four species of mammals, 299 species of birds, 59 species of amphibians and reptiles and 91 species of fish (including peripheral species). There is a species list available for the reserve.

CULTURAL HERITAGE There are also a number of abandoned town sites representing 18th and 19th century business ventures.

ZONING/CONSERVATION MANAGEMENT Coastal areas not subject to CMP but under jurisdiction of CAFRA. See comprehensive Management Plan, Article 5 outlines standards, article 6 outlines activities subject to management. A Land Capability map defines distribution of types.

STAFF No information

LOCAL ADMINISTRATION Pinelands Commission, State of NJ, PO Box 7, New Jersey 08064.

VISITOR FACILTIES No information

SCIENTIFIC RESEARCH AND FACILITIES Fairly extensive research activity - both applied and basic - Rutgers University maintains a blueberry/cranberry experiment station and a marine station. USFS has conducted a number of forestry oriented studies over a long period of time, Brigantine has focused on wildlife studies. Much of the basic scientific knowledge of the Pine Barrens is summarised in Forman (1979). The Rutgers Division of Pinelands Research was recently (1981) established to help coordinate research efforts in the area. Research includes monitoring of water quality and forest fire management; climate, vegetation, hydrology and pollution studies. Field stations include: Lebanon USFS, Rutgers, Little Egg, Blueberry/Cranberry Station, Atlantic City, Chatsworth, Hammonton.

LOCAL POPULATION Atlantic City to the east is the largest nearby town and Hammonton is an important local trade and agricultural centre. The reserve contains numerous small towns and villages scattered throughout including Chatsworth, Batsto and Greenbank.

MODIFICATION OF THE NATURAL ENVIRONMENT About 5% of the reserve is under agriculture (including indigenous blueberry and cranberry culture as well as row crops) and 9% is developed (residential, commercial, transportation arteries). Major areas preserved in national and state holding include Brigantine Wildlife Refuge, Lebanon State Forest, Wharton Tract and Bass River State Forest. Atlantic City and other coastal development areas are significant on the eastern boundary. Large retirement communities ir several locations are also of significance.

PRINCIPAL REFERENCE MATERIAL

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McCormick, J. (1970). The Pine Barrens: A Preliminary Ecological Inventory. NJ State Museum Report #2.

New Jersey Pinelands Commission - Comprehensive Management Plan for the Pinelands National Reserve (National Parks and Recreation Act, 1978) and Pinelands Area (NJ Pinelands Protection Act, 1979). Pinelands Commission, State of NJ, New Lisbon, NJ 08064.

Mojave and Colorado Deserts Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION See individual sheets

DATE ESTABLISHED 1984 as a Biosphere Reserve

GEOGRAPHICAL LOCATION This reserve is located in several regions of California; Death Valley National Monument is in east California; Joshua Tree National Monument, Philip L. Boyd Deep Canyon Desert Research Centre, Anza Borrego Desert State Park are located in Southern California.

ALTITUDE See individual sites

AREA The reserve encompasses an area of 1,297,264ha: Death Valley National Monument 836,799ha; Joshua Tree National Monument 226,609ha, Philip L. Boyd Deep Canyon Desert Research Centre 11,271ha and Anza Borrego State Park 22,585ha.

LAND TENURE See individual sites

PHYSICAL FEATURES The reserve consists of two deserts, the Colarodo Sonoran Desert and the geologically and biologically distinct Mojave Desert.

VEGETATION The Colorado Sanoran Desert includes such trees and shrubs as Californian fan palm Washingtonia filifera, Parry nolina Nolina bigelovii var. bigelovii, desert apricot Prunus fremontii, dalea Dalea fremontii var. simplifolia and D. schotlii, California lote bush Condalia parryi, vasey sage Salivia vaseyi and the saguaro cactus Cereus giganteus. The Mojave Desert's main indicator is the Joshua tree Yucca brevifolia but other plants almost exclusively confined to this desert are the Parry saltbush Atriplex parryi, Indigo bush Dalea fremontii var. Saundersii, Mojave sage Salvia mohavensis and Bur sage Ambrosia eriocentra.

FAUNA Colarado Sonoran Desert: peninsular bighorn sheep Ovis canadensis cremnobates, desert slender salamander Batrachoseps aridus, switak's barefoot gecko Anarbylus switaki, leaf-toed gecko Phyllodactylus xanti, Colorado desert fringe-toed lizard Uma notata, Coachella Valley fringe-toed lizard Uma inornata, banded rock lizard Petrosaurus mearnsi, flat-tailed horned lizard Phrynosoma m'calli, granite spiny lizard Sceloporus orcutti, small-scaled lizard Urosaurus microscutatus, granite night lizard Xantusia henshawi. Mojave Desert: Mojave green rattlesnake Crotalus scutulatus, panamint kangaroo rat Dipodomys panamintinus, panamint chipmunk Eutamias panamintinus, rock squirrel Spermophilus variegatus.

CULTURAL HERITAGE See individual sites

ZONING/CONSERVATION MANAGEMENT See individual sites

STAFF See individual sites

LOCAL ADMINISTRATION See individual sites

VISITOR FACILITIES See individual sites

SCIENTIFIC RESEARCH AND FACILITIES See individual sites

LOCAL POPULATION See individual sites

MODIFICATION OF THE NATURAL ENVIRONMENT See individual sites

PRINCIPAL REFERENCE MATERIAL
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Bureau of Land Management (1983). Chuckwalla Bench ACEC Management Plan and Environmental Assessment. In draft.
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Mojave and Colorado Deserts Biosphere Reserve: Anza Borrego Desert State Park

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION Congressional acts in 1932-33 transferring title from federal to state government State park established in 1933 by action of State Park Commission.

DATE ESTABLISHED State park established in 1933, accepted as a Biosphere Reserve in 1984.

GEOGRAPHICAL LOCATION Eastern San Diego County. Ninety miles east of the city of San Diego, California. Small portions of the park are in Riverside and Imperial Counties. It includes a western portion of Colorado Desert and eastern slopes of the Peninsular Ranges. 33°10'N, 116°20'W.

AREA 222,585ha

LAND TENURE Owned by the state

PHYSICAL FEATURES Anza-Borrego Desert State Park contains high barren peaks of the Southern California batholith and excellent tertiary sedimentary sequences containing rich fossil assemblages. The park includes granitic, volcanic and sedimentary rocks. The Borrego Badlands in the northeastern part of the park is a maze of barren steep-sided ravines and twisting dry creek beds. Rugged peaks and ranges surround the Borrego Sink. Recent fossil discoveries include a mammoth cranium and camel tracks in situ. Branches of the San Jacinto and Elsinore fault zones cut through the park.

VEGETATION The park contains the entire U.S. population of the state listed rare pennisular bighorn sheep Ovis canadensis cremnobates and the entire range of the state listed desert slender salamander Batrachoseps aridus which is also on the federal list. Other listed species include Switak's barefoot

gecko Anarabylus switaki and least Bell's vireo Vireo belli pusilus. A species list is available, also available is a list of endangered species found in the park.

FAUNA Rare or endangered plants listed by the Californian Native Plant Society include Ayenia compacta, Chaenactis parishii, Ditaxis adenophora, D. californica, Marina orcuttii var. orcuttii, Penstemon californicus and Salvia eremostachyma.

ZONING/CONSERVATION MANAGEMENT The bulk of the park's 222,585ha is classified as State Park Wilderness (162,000ha). Approximately 20,250ha is classified as state park. 20,250ha is a private enclave (town of Borrego Springs) surrounded by park. 5,670 is Ocotillo Wells State Vehicular Recreation Area adjacent to the east boundary of the park. There is no management plan for the park.

STAFF The park has a total staff of 25.

LOCAL ADMINISTRATION Manager, Anza Borrego Desert State Park, P.O. Box 428, Borrego Springs California 90024, USA.

VISITOR FACILITIES There is a visitor centre, nature trails, conducted nature walks and campfire programs in the park.

SCIENTIFIC RESEARCH AND FACILITIES There have been long-term (15 year) programmes of palaeontology research and data collection in bighorn sheep. Many theses have been carried out on various aspects of the natural history of the park. The scientific facilitities available in the park include a small laboratory at the visitor centre and another small palaeontological laboratory at the park headquarters.

MODIFICATION OF THE NATURAL ENVIRONMENT Cattle grazing in the park was discontinued in 1971. Illegal use of vehicles off-road has left scars in the park. Old mining roads are present in several areas. There are also some small plots cleared for homesteads, agriculture etc.

PRINCIPAL REFERENCE MATERIAL
There is a bibliography of the papers produced from research carried out in the park at the park headquarters.

Mojave and Colorado Deserts Biosphere Reserve: Death Valley National Monument

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION Totally protected, but lands are open to mining on claims valid as of 9.28.78. Decrees protecting the monument: National Monument February 11, 1933. Presidential Proclamation No. 2228 enlarging Death Valley National Monument. March 26, 1937. Presidential Proclamation No. 2961 addition of Devils Hole, Nevada to Death Valley National Monument, January 17, 1952.

DATE ESTABLISHED Accepted on the 11th February 1933 as a National Monument, and 1984 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION South-eastern California and south-western Nevada: 35°39'-37°05'N, 116°22'-117°37'E.

ALTITUDE 86m below sea level to 3,368m

AREA The monument covers an area of 839,870ha

LAND TENURE Federal ownership (excluding mineral rights): 831,846ha; State of California ownership (undeveloped): 5,377ha; private: 2,647ha.

PHYSICAL FEATURES Death Valley, the principal feature, is about 1,300 sq.km, lying below sea level (including the lowest land point in the western hemisphere). Rugged, sparsely vegetated mountains border a north-south oriented valley, and are incised by numerous deep rocky canyons terminating valleyward in huge alluvial fans. Rocks range in age from Precambrian to Recent; Mesozoic rocks are poorly represented. Rock types are diverse - limestone, quartzite, shale, granite, quartz monzonite, basalt, to modern halite sheets on valley floor. Fault scarps, badlands, deep canyons, maar craters, salt marshes are a few features. The valley is drained internally by rivers which are ephemeral except for Salt Creek in the north. It has a continental dry climate with flash floods; the maximum recorded temperature is 57°C, the minimum -9°C, with an total annual precipitation of 42-127mm.

VEGETATION There are an estimated 600 species of flora with winter and spring-blooming annuals of special interest and 13 species of cactus. Lower and middle elevations are dominated by shrubs such as creosotebush Larrea divaricata, sagebrush Atriplex spp., mormon tea Ephedra sp. and blackbrush Coleogyne ramossissima. Trees include Utah juniper Juniperus osteosperma, one needle pine Pinus monophylla, bristlecone pine P. longaeva and limber pine P. flexilis. Approximately 21 species are endemic.

FAUNA Fifty-one species of native mammals, 36 species of reptiles, three of amphibians and six of fish are present. Noteworthy mammals include ten species of bat, three species of rabbits and hare and 27 of rodents, plus porcupine Erethizon dorsatum, coyote Canis latrans, kit fox Vulpes velox, grey fox Urocyon cinereoargenteus, ringtail or cacomistle Bassariscus astutus, spotted skunk Spilogale putorius, mountain lion Felis concolor, bobcat Felis rufa, mule deer Odocoileus hemionus and desert bighorn sheep Ovis canadensis nelsoni (the species as a whole is classified as vulnerable). More than 100 birds of the 258 recorded species are resident or occupy seasonal habitats. Rare or endangered species include prairie falcon Falco mexicanus, peregrine F. peregrinus and yellow-billed cuckoo Coccyzus americanus. Reptiles include the desert tortoise Gopherus polyphemus agassizi, another species rated in the Red Data Book as rare; 18 lizards including an endemic, the panamint alligator lizard Gerrhonotus panamintinus and 17 snakes. Four of the five native species of pupfish Cyprinodon are endemic to Death Valley, C. diabolis being reduced to approximately 200 individuals and classified as an endangered species.

ZONING/CONSERVATION MANAGEMENT A zonation for the park is available. There is no management plan.

STAFF In 1984 there were 45 permanent and full-time persons on the staff between October and April there were also 61 temporary employees.

LOCAL ADMINISTRATION Superintendent, National Park Service, Death Valley National Monument, Death Valley, California, 92328 USA.

VISITOR FACILTIIES Campgrounds, a visitor centre and interpretative services are provided.

SCIENTIFIC RESEARCH AND FACILITIES Part of the monument was studied under the IBP programme (desert marsh ecosystem) and 1980 research involved 45 investigators working on 45 projects: Geology/Geophysics: 13; Palaeo-Ecology: six; Taxonomy: four; Plant Ecology: seven; Hydrology: one; Mammals: three; Fish one; Invertebrates: eight; Remote Sensing: two. Scientific facilities include two climatic stations and accommodation for scientists.

LOCAL POPULATION Four settlements for employment are located in the monument.

MODIFICATION OF THE NATURAL ENVIRONMENT Mining activities, unlawful operation of off-road vehicles and the presence of large numbers of feral donkeys Equus asinus occur. Trespass grazing by cattle occurs on about 40,000ha. About 700,000 visitors per year come to the park during the season, October 15 to April 30.

PRINCIPAL REFERENCE MATERIAL

Clark, W. (1972). Death Valley, Story Behind the Scenery. K.C. Publications, Las Vegas, Nevada.

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Mojave and Colorado Deserts Biosphere Reserve: Joshua Tree National Monument

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION Total

DATE ESTABLISHED Accepted on the August 10 1936 as a National Monument, and 1984 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION 20km east of Los Angeles, California. Riverside and San Bernardino counties, at the southern margin of the Mojave desert. It is located in a transverse range of arid mountains in the Mojave Desert. The Morongo Basin, adjacent to the length of the northern boundary is the location of the nearest communities of Yucca Valley, Joshua Tree and Twentynine Palms, California: the southern boundary lies along the San Andreas Fault in the Coachella Valley. 34°N, 115°45'W.

ALTITUDE 305-1,681m

AREA 226,609ha

LAND TENURE There are privately owned inholdings of 1,333ha, state and county-owned lands of 2,983ha and government owned lands of 222,296ha.

PHYSICAL FEATURES The monument consists of low, generally north-west trending mountains interspersed with intermontane valleys. It is predominantly a crystalline rock terrain, although its valleys are largely mantled by unconsolidated or poorly consolidated Quaternary surficial deposits. Rocks in the monument comprise metamorphic assemblages that include Paleozoic and Precambrian rocks, widespread Mesozoic plutonic rocks that range from gabbro to quartz monzonite, and some local Cenozoic basalt. High seismic activity in the monument area is largely attributable to the proximity of the San Andreas fault zone to the west and to elements of the Transverse Range fault within the Monument. The average annual precipitation (mostly in winter) ranges from 25 to 120mm. Surface water is restricted to a few intermittent springs, four natural oases and several human-made catchment ponds. Air temperatures range from below 0°C in January to 50°C in the Pinto Basin during midsummer.

VEGETATION The diversity of the flora of the area is indicative of the Monument's location in a transition zone between the Colorado Desert and the Mojave. Characteristic species of the lower or Colorado Desert include: Washingtonia filifera, W. olneya and W. esota, Parosela spinosa, Cerceidium floridum, Hyptis emoryi, Fouquieria splendens, Beloperone californica. Mojave desert species include: Yucca brevifolia, Yucca schidigera, Populus fremontii, Nolina parri, Chilopsis linearis, Larrea divaricata. Twenty-six plants of a rare or limited distribution status occur in Joshua Tree. Eleven of these are listed as very rare and endangered.

FAUNA There are over 50 species of mammals, 16 species of lizards, 19 species of snakes, two amphibians and 233 birds present. Noteworthy mammals include kit fox Vulpes velox, coyote Canis latrans, grey fox Vulpes cinereoargenteus, ringtail Bassariscus astutus, mountain lion Felis concolor, bobcat F. rufa, mule deer Odocoileus hemionus and desert bighorn sheep Ovis canadensis nelsoni. Many birds migrate through the Monument. Resident birds include prairie falcon Falco mexicanus, golden eagle Aquila chrysaetos, phainopepla Phainopepla nitens, roadrunner Geococcyx californianus, cactus wren Campylorhynchus brunneicapillus and ladder-backed woodpecker Dendrocopos scalaris. Reptiles include the desert tortoise Gopherus agassiz and six species of Viperidae.

CULTURAL HERITAGE The oldest sites are found in the Pinto Basin. Dated as post-Pleistocene in age, these sites are some of the first "early man" areas to be indentitified in California. Petroglyphs and pictographs remain from several recent Indian cultures.

ZONING/CONSERVATION MANAGEMENT The total monument covers an area of 226,609ha, consisting of seven wilderness units (170,910ha), potential

wilderness additions (12,440ha), historic areas (512ha), developed areas (381ha), day use areas (9,972ha) and private lands (3,173ha). Although the monument does not have a General Management Plan, a Statement or Management and a Natural Resources Management plan have been prepared.

STAFF There are 33 permanent employees and 25 seasonals

LOCAL ADMINISTRATION Superintendent, Joshua Tree National Monument, 74485 National Monument Drive, Twentynine Palms, CA 92277.

VISITOR FACILITIES Visitor facilities include visitor centres, campsites and trails.

SCIENTIFIC RESEARCH AND FACILITIES Completed scientific studies include approximately 14 geological, four climatological, six vegetational, 34 wildlife and four fire ecology investigations. Most of these studies and the ten studies currently in progress are conducted by University and college personnel. There are no facilities.

MODIFICATION OF THE NATURAL ENVIRONMENT Cattle grazing and mining operations of the past have affected the area.

PRINCIPAL REFERENCE MATERIAL

Bibliographies and most references are available through the Joshua Tree National Monument library.

Miller, A. and Stebbins, R. (1964). The Lives of Desert Animals in Joshua Tree National Monument. Univ. Cal. Press, L.A., CA.

Mojave and Colorado Deserts Biosphere Reserve: Philip L. Boyd Deep Canyon Desert Research Centre

BIOGEOGRAPHICAL PROVINCE 1.08.07 (Sonoran)

LEGAL PROTECTION No information

DATE ESTABLISHED The Natural Land and Water Reserves System was established by the University of California Board of Regents in 1965 and the Boyd Canyon Desert Research Center was established as one of the initial nine reserves. Accepted in 1984 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION 24km south-east of Palm Springs City, Riverside County, California. 33°30'N, 116°24'W.

ALTITUDE 165-2,390m

AREA The research centre covers an area of 11,274ha. The Philip L. Boyd Deep Canyon Desert Research Centre has 6,714ha and the San Bernadino National Forest has 4,560ha.

LAND TENURE 2,318ha (5,728 acres) are owned by the Regents of the University of California and were given to the University by Mr. Phlip L. Boyd. the U.S. Bureau of Land Management owns 4,137ha (10,222 acres) which are managed by the University under a cooperative agreement. There are some interspersed State Fish and Game lands managed as protected habitat for Bighorn Sheep. An additional 259 hectares (640 acres) is under lease from the Forest Service. Lands within the San Bernadino National Forest are managed by the Forest Service.

PHYSICAL FEATURES The Philip L. Boyd Deep Canyon Desert Research Centre forms a major portion of an entire drainage system on the north flank of the Santa Rosa Mountains; intermittent desert mountain stream; permanent pools; the north-trending Deep Canyon is a fault-controlled valley separating a pre-Cretaceous metasedimentary assemblage of gneiss, schist, quartzite, marble and hornfels on the east from late-Cretaceous granodioritic intrusions of the southern California batholith on the west; several faults crossing the reserve are associated with the San Andreas and San Jacinto fault zones which trend north-west-south-east on either side of the Santa Rosa-San Jacinto mountain range; faulting continues along these two major fault zones, no displacement of recent sediments has occurred on the reserve; young stream fill and outwash fan debris has been accumulating since the last uplift of the mountain in the mid-Pleistocene. Mean highest monthly temperature (July) 39°C, mean lowest monthly temperature (January) 9.5°C. Mean annual precipitation is 116mm.

VEGETATION Philip L. Boyd Deep Canyon Desert Research Centre: Sonoran creosote bush scrub; enriched desert scrub; semi-desert chapparral; desert dry wash woodland; palm oasis woodland; 69 families, 210 genera, 309 species including Larrea tridentata, Encelia farinosa three spp. Opuntia, Fouquieria speldens, Chilopsis linearis, Beloperone californica, Washingtonia filifera, Agave deserti, Yucca schidigera, Juniperus californica, Quercus dumosa, Pinus monophylla. San Bernadino National Forest: Vegetation types also include California pinyon-juniper woodlands and mixed conifer forest. There is a species list available for the area.

FAUNA Three amphibians Bufo punctatus, Hyla cadaverina and the endangered Batrachoseps aridus: 40 reptiles, including Gopherus agassizi, Phyllodactylus xanti, Phrynosoma platyrhinos, Crotalus ruber; 143 birds including Bueo jamaicensis, Falco sparverius, Lophortyx gambelii, Geococcyx californianus, Phainopepla nitens; 35 mammals include Lepus californicus, five species of Perognathus, two species of Dipodomys, ten species of bat Canus latrans, Bassariscus astutus, Lynx rufus, and the rare Ovis canandensis cremnobates. There is a species list availalble for the area.

ZONING/CONSERVATION MANAGEMENT No formalized management has yet been developed but research and management activity is reviewed by a management advisory committee for the Philip L. Boyd Deep Canyon Desert Research Centre. Forest Service lands: a draft forest land management plan was scheduled for public review in late 1985.

STAFF There are three permanent staff on the unit.

LOCAL ADMINISTRATION Natural Land and Water Reserves System, c/o 681 University Hall, University of California, Berkeley, CA 94720. San Bernadino National Forest Land: Regional Forester U.S.D.A. Forest Service, Pacific Southwest Region, 630 Sansome Street, San Francisco, CA 94111.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES In a 20-year period, 130 scholarly works have been published. Much work on biological adaptions to extremes of heat and aridity; insect systematics; ecophysiology of plants including Crassulacean acid metabolism; survival of amphibians in such arid areas; thermoregulation, reproduction/environmental relationship and behaviour of reptiles, avian energy relationships and behaviour; small mammal and bighorn sheep ecophysiology. The "Deep Canyon Transect: has been established and consists of 32 permanent line transects (23 of them on the reserve proper) and

19 permanent photo sites (18 of them on the reserve proper). Measurements include plant and animal population data. The "transect" is designed to sample the full array of habitat types from elevations of 2,657m to 9m. Those plots not in the reserve proper are on U.S. Forest Service land or BLM land. The scientific facilities available in the unit include, field stations, experimental plots, five climatic stations and accommodation for five to ten scientists.

LOCAL POPULATION North is a high population urban area with golf course just off reserve property.

MODIFICATION OF THE NATURAL ENVIRONMENT The core of the reserve is in rugged, undisturbed terrain. Approximately 6km of two-lane highway traverses the western edge of the Deep Canyon rim, but there are no roadside developments. Immediately to the south are mountain habitats of the Santa Rosa Mountains and still further to the south is undisturbed terrain blending into the Sonoran Desert including a large state park. Combined open country and rural residential developments are found to the west. The site complements reserve values at Joshua Tree National Monument 40km to the north-east. North of that 96km is the Granite Mountains Reserve.

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Carolinian-South Atlantic Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION No information

DATE ESTABLISHED 1986 as a Biosphere Reserve

GEOGRAPHICAL LOCATION Two distinct regions and a transition zone have been identified within the Caroilinian-South Atlantic Biosphere Reserve: the area from Cape Fear to Cape Hatteras, dominated by long, narrow barrier islands with few inlets, cuspate capes, and small tidal amplitudes; the Georgia Embayment, with the large sea islands, numerous inlets and large tidal amplitudes; and the transitional area, located primarily along the coast of South Carolina.

ALTITUDE See individual sites

AREA The Biosphere covers an area of 118,463ha. The Outer Banks Subregion consists of 55,789ha with a Core area of 11,500ha. The Santee Delta-Cape Romain Subregion covers an area of 32,474ha with a core are of 2,242ha. The Sea Islands Subregion covers an area of 53,321ha with a core are of 36,740ha.

LAND TENURE The Biosphere Reserve brings together protected areas owned by the country, state, Nature Conservancy, the Bureau of Outdoor Recreation and private land owners.

PHYSICAL FEATURES See individual sites

VEGETATION See individual sites

FAUNA See individual sites

CULTURAL HERITAGE See individual sites

ZONING/CONSERVATION MANAGEMENT The Carolinian-South Atlantic Biosphere Reserve contains three subregions: Outer Banks Subregion, Santee Delta-Cape Romain Subregion, Sea Islands Subregion.

Carolinian-South Atlantic Biosphere Reserve: Outer Banks Subregion

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION Total

DATE ESTABLISHED Established in 1966 as a National Seashore. Accepted as a Biosphere Reserve in 1986.

GEOGRAPHICAL LOCATION The unit is located in Carteret Country, North Carolina, and extends offshore to the continental shelf to include the Ten Fathom Ledge/Big Rock area. The landward portion of the unit is located completely within the boundaries of Cape Lookout National Seashore. The unit is entirely offshore, about 3km from Beaufort, NC at is closest point and 65km at its furthest. The western end is also 4km from Morehead City, NC. A portion of the unit (Shackleford Banks) is at the mouth of the North River with Bank Sound between, while the eastern portion (Core Banks and Portsmouth Island) fronts Core Sound. Ten Fathom Ledge includes two sites; the inner shelf site is 58km offshore at 34°20'N, 76°33'W, and the outer shelf sites, Big Rock is at 34°98'N, 76°12'W.

ALTITUDE 0-10m

AREA The unit covers a total area of 55,789ha with a core area of 11,500ha. 11,500ha in the Cape Lookout National Seashore and 44,289ha in the Big Rock area and Ten Fathom Ledge.

LAND TENURE The whole subregion is state owned

PHYSICAL FEATURES The unit contains three basic types of coastal barrier islands: cuspate cape (Cape Lookout); linear washover/inlet (Core Banks and Portsmouth Island); and linear arcuate dune ridge barrier (Shackleford Banks). The barrier islands are separated by Drum Inlet; other inlets in the

eastern unit are temporary. Both Barden's Inlet and Beaufort are artifically maintained by dredging. Ten Fathom Ledge includes six separate hard ground ledges of varying relief, displaying similar tropical algal and coral communities. The average annual temperature 17°C and the mean annual precipitation 1321mm.

VEGETATION Cape Lookout: Communities with some of the dominant species include: maritime forest (live oak, cedar, holly); coastal shrubland (Bayberry, yaupon holly, groundsel bush, scrub oak); coastal grasslands (dune strand species and barrier flat vegetation, dominated by sea oats and salt meadow cordgrass); coastal marshes (salt marsh smooth cordgrass, with salt meadow cordgrass and needle rush in the upper tidal zone); intertidal (algae along jetties); subtidal hard bottoms (tropical algae and corals); subtidal grass beds (eel grass, widgeon grass). Ten Fathom Ledge: At least 40 algal species, dominated by brown algae, have been recorded; occurrence and abundance is seasonal. There is a species list available for the unit.

FAUNA Cape Lookout: The fauna is diverse and representative. Included are a variety of shore birds, grassland birds, both resident and migratory species. Great numbers of little tern Sterna albifrons, gullbilled tern Gelochelidon nilotica, common tern Sterna hirundo, and black skimmer Rynchos niger nest in colonies along the beach/berm. Endangered eastern brown pelican Pelecanus occidentalis are residents, and loggerhead sea turtles nest along the beaches. Tree frogs, toads, turtles and snakes are present; shrews, raccoons and rabbits are found in the shrub thickets. Feral livestock are present on Shackleford Banks. Ten Fathom Ledge: Nearly 100 species of fish have been identified; included are black sea bass, gog, scamp, various porgies and hog-fishes, purple reef fish and yellowtail reef fish.

ZONING/CONSERVATION MANAGEMENT Cape Lookout is a core area; Ten Fathom Ledge/Big Rock is an offshore cooperative use area. There is a management plan for the unit. The management plan for the Cape Lookout National Seashore addresses management zoning (i.e., natural, historic, development, special use), natural resources management, cultural resources management, interpretation and visitor use, and general development.

STAFF There are 18 permanent staff and 13 temporary staff in the unit.

LOCAL ADMINISTRATION Superintendent, Cape Lookout National Seashore, P.O. Box 690, Beaufort, North Carolina 28516; and NOAA Marine Sanctuaries Program, 3300 Whitehaven Street, N.W., Washington, D.C. 20036.

VISITOR FACILITIES None

SCIENTIFIC RESEARCH AND FACILITIES The Outer Banks have been the subject of a considerable amount of scientific research. Studies include the geology, ecological effects of over-wash, vegetation, dune stabilization, ecology of dune strand plants, stabilization of dredge spoil, rates of beach recession, and general barrier island ecology. Several masters theses and doctoral dissertations have resulted, along with numerous publications. Long term monitoring on Cape Lookout includes, turtle surveys, changes in beach erosion and accretion, vegetation transects, physiography, fire studies, visitor use and bird censusing. There is long term monitoring on Ten Fathom Ledge of the fish species present. Scientific facilities in the unit include a field station, experimental plots, a climate station; accommodation is available for scientists in the National Park Service headquarters and a nearby marine laboratory.

MODIFICATION OF THE NATURAL ENVIRONMENT The system of islands, marshes and lagoons has not been modified extensively by human activities and therefore continues to operate under normal physical conditions for this coast. The region does support a substantial marine ecosystem on both sides of the barrier islands, which is relatively undisturbed except for the many years of commercial fishing. There are no permanent campgrounds or other facilities other than minimal structures needed for park use. The Ten Fathom Ledge area is subjected to recreational use by man, including scuba diving and fishing. Commercial trawling occurs over some low-relief hard grounds.

PRINCIPAL REFERENCE MATERIAL

Cape Lookout:

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Carolinian-South Atlantic Biopshere Reserve: Santee Delta-Cape Romain Subregion

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION Cape Romain Refuge: Closed to Migratory Bird Hunting by Presidential Proclamation 2000. Wilderness Area protected by Public Law 93-632. Yawkey Wildlife Centre: State land under Carolina Heritage Trust Agreement and Casement enacted Act No. 600. Santee Coastal Reserve: No information. Washoo Reserve: No information. Capers Island: No information.

DATE ESTABLISHED Cape Romain Refuge: Established, excluding Bull Island, in 1932. Bull Island added to refuge in 1936. Yawkey Wildlife Centre: No information. Santee Coastal Reserve: No information. Washoo Reserve: No information. Capers Island: Established in 1975.

GEOGRAPHICAL LOCATION The reserve is bordered on the east by the Atlantic Ocean, on the west by the Intracoastal Waterway, on the north by the North Inlet estuary and on the south by Capers Inlet. The entire reserve is included in two counties, Charleston and Georgetown. It is approximately 32km miles north-east of the city of Charleston and approximately 10 miles east of the city of Georgetown. Across the Intracoastal waterway to the west is the Frances Marion National Forest. 33°07'N, 79°20'W.

ALTITUDE 0-12.8m

AREA The unit covers an area of 32,474ha, with a core area of 2,242ha. Washoo Reserve - 421ha, Yawkey Wildlife Centre - North Island: 1,821ha and South, Cat Islands: 6,659ha, Cape Romain Refuge - 13,858ha, Capers Island - 809ha, Santee Delta Reserve - 8,906ha.

LAND TENURE Cape Romain Refuge, Yawkey Wildlife Centre and Santee Coastal Reserve are all State owned. Washoo Reserve is owned by the Nature Conservancy and Capers Island owned by the Bureau of outdoor recreation.

PHYSICAL FEATURES Located in the lower coastal plain in the Carolinian-South Atlantic region. The unit contains representative communities of the region, as well as unique features. It includes nine contiguous barrier islands, a true embayment (Bull's Bay), cuspate foreland (Cape Island) and seven major estuaries (North Inlet, Winyah Bay, and North and South Santee Rivers). There are extensive salt marshes, with numerous inlets and small islands; areas of impounded marsh for rice culture are also present. Pleistocene sediments compose the core of the barrier islands formed in response to sea level rise. Tides are in the mesotidal range with numerous tidal inlets, extensive salt marshes, beach ridge barrier islands with maritime forests. Special features include: significant river delta on the Atlantic coast of the U.S., a true embayment, cuspate foreland, and extensive impoundments. The mean annual temperature is 19°C and the mean annual precipitation is 1320mm.

VEGETATION Commonly found species: Salt Marsh - smooth cordgrass, and saltmeadow cordgrass. Dune community - sea oats, panic grass, sandspur, beach pennywort, brown sedge, prickley pear, cabbage palmetto, wax myrtle. Transition and shrub communities - wax myrtle, yaupon holly, red bay, eastern red cedar, live oak, catbrier, pepper vine, trumpet vine, Virginia creeper, sea myrtle, sea ox-eye, black needlerush. Maritime forest - live oak, laurel oak, cabbage palmetto, magnolia, loblolly pine, southern red cedar, yaupon holly, red bay, and American holly. Other communities also include bald cypress-tupelo, gum swamp, and pocosins. Threatened plants include Sarracenia rubea and Dioneae muscipula. A species list is available for the unit.

FAUNA A species list is available for the unit

ZONING/CONSERVATION MANAGEMENT Core Areas - North Island 1,821ha. Wilderness area under the Yawkey will, no management activities allowed. Use restrictions under the Nature Conservancy to protect the sensitive rookery area. Buffer zones - 38,664ha. The remaining areas are in the buffer zones and are managed for wildlife species including waterfowl, deer, turkey and endangered species. The Yawkey Wildlife Centre's management plan is structured around the stipulations in the will of the late Mr Tom Yawkey. It allowed for research, management and education on the majority of the property except for North Island. The Santee Coastal Reserve, (including the Washoo Reserve), Cape Romain and Caper Island all have management plans addressing the various management practices and the species involved.

STAFF There are a total of 35 staff in the unit.

LOCAL ADMINISTRATION S.C. Wildlife and Marine Reserve, P.O. Box 12559, Charleston, South Carolina 29412.

VISITOR FACILITIES Cape Romain Refuge: There is a new visitor contact station with various exhibits depicting refuge wildlife, informational

pamphlets and species lists. Yawkey Wildlife Centre: Weekly educational field trips for 14 persons available. Graduate student field trips as requested. Inspection of prototype management activities as requested. Cape Romain Refuge: Nature trails for hiking. Santee Coastal Reserve: Nature trails and broadwalks.

SCIENTIFIC RESEARCH AND FACILITIES Waterfowl related research, impounded and unimpounded marsh ecology, forest wildlife research, endangered species ecology, and coastal wilderness research are major activities. Experimental impoundments with individual water control structures were available with much base line information already collected. Access restricted by ferry operation on Yawkey Centre. The area is important in coastal process and geology since the diversion of the Santee River in 1940 and the scheduled redivision in the near future. Many of the islands and areas are boat access only. All local populations are monitored to some degree. There is especially detailed monitoring of populations of endangered and threatened species. Loggerhead turtles, bald eagles Haliaeetus leucocephalus, osprey Pandion haliaetus, red-cockaded woodpecker Picoides borealis as well as game species. The scientific facilities available in the unit include a field station, experimental plots and four small dorms on Yawkey and one on Cape Romain.

LOCAL POPULATION There are 14 family dwellings on the entire reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT The marshland areas throughout the reserve have been modified in the recent past by the culture of rice in the 1800s. Some marsh has reverted to wild marsh. Other areas have been retained as impounded and are actively managed for waterfowl. Other than this, there is very little development. All roads are dirt, and buildings have been kept to a minimum as needed for maintenace. The North Island Light-house was listed as a National Historic Landmark on December 30, 1974. There is boat traffic along the western border in the Intracoastal Waterway. Some areas on Yawkey Centre and Santee Coastal Reserve have been converted from natural mixed forest to pine forest.

PRINCIPAL REFERENCE MATERIAL Studies and reports from Tom Yawkey Wildlife Centre are available.

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Carolinian-South Atlantic Biosphere Reserve: Sea Islands Subregion

BIOGEOGRAPHICAL PROVINCE 1.06.05 (Austroriparian)

LEGAL PROTECTION Level of protection for all sites is high. Cumberland Island National Seashore: establishment of seashore (P.L. 92-536) and wilderness designation (P.L. 97-250), Blackbeard Island National Wildlife Refuge: designation of wilderness area (P.L. 93-632), Sapelo Island National Estuarine Sanctuary: establishment of the National Estuarine Sanctuary Program (P.L. 92-583), Gray's Reef National Marine Sanctuary: establishment of the National Marine Sanctuary Program (P.L. 92-532), Lewis Island Natural Area: acquisition under Georgia Heritage Trust Act (GA Laws, 1974, p. 962) and designation as a Registered National Natural Landmark, Wolf Island National Wildlife Refuge: designation of wilderness area (P.L. 93-632), Little St. Simon's: protected under coastal barrier resources act.

DATE ESTABLISHED 1986 as a Biosphere Reserve

GEOGRAPHICAL LOCATION The Sea Islands Unit is composed of ten sites: Blackbeard Island National Wildlife Refuge and Blackbeard Island Wilderness, R.J. Reynolds State Wildlife Management Area and Sapelo Island National Estuarine Sanctuary (both on Sapelo Island), Wolf Island Wilderness, Lewis Island Natural Area, Little St. Simon's Island, Cumberland Island National Seashore, and Gray's Reef National Marine Sanctuary. All are off the coast of Georgia. Blackbeard Island Wilderness (31°30'N, 81°15'W), Sapelo Island National Estuarine Sanctuary (31°23'N, 80°51'W), Gray's Reef National Marine Sanctuary (31°23'N, 80°51'W), Lewis Island Natural Area (41°23'N, 81°34'W), Cumberland Island National Seashore and offshore to 3 miles (30°50'N, 81°26'W), Blackbeard Island National Wildlife Refuge (31°30'N, 81°12'W), Richard J. Reynolds State Wildlife Refuge (31°28'N, 81°14'W), Altamaha State Waterfowl Management Area (31°20'N, 81°25'W) and Little St. Simon's Island.

ALTITUDE 0-20m

AREA The unit covers an area of 53,321ha with a core area of 36,740ha. Core: Cumberland Island 6,113ha, Cumberland Island offshore 13,135ha, Sapelo Island NES 3,745ha, Lewis Island NA 6,000ha, Wolf Island NWR 2,075ha, and Gray's Reef 5,672ha. Buffer: Blackbeard Island NWR 2,274ha, Little St. Simon's 931ha, Altamaha SWMA 10,040ha and R.J. Reynolds SWR 3,336ha.

LAND TENURE All areas within both the core and buffer area, with minor exception, owned by the State of Georgia or the Federal Government. Of the core areas, approximately 233ha are owned by the State and 16,330ha by the Federal Government. Privately owned lands are 1,684ha.

PHYSICAL FEATURES The Sea Island unit represents a barrier coast with a gently sloping coastal plain and continental shelf. There are extensive marsh-dominated estuaries, and Pleistocene-cored barrier islands with Holocene beaches, formed in response to fluctuations in sea level. The dominant energy source is tidal, with fluctuations in the mesotidal range (2-3m). The offshore area has a sloping sand bottom with outcroppings of hard limestone which form the basis for live bottom reef communities. Mean annual temperature is 20.4°C, mean annual precipitation is 1232mm.

VEGETATION Communities with some of the dominant species include: dunes (sandspur, sea oats, beach pennywort, Russian thistle); interdune flats (Bayberry, saw palmetto, Spanish bayonet); upland forests (live oak, palmetto,

magnolia and pine); fresh water ponds (emergent grasses, sedges, rushes, duckweed); salt marsh (smooth cordgrass); coastal swamp forest (gum, cypress, tupelo); marine (planktonic and benthic algae; intertidal algae). A species list exists for the unit.

FAUNA Characteristic, unusual and endangered species include the loggerhead sea turtle, eastern brown pelican, American alligator Crocodylus acutus, Florida manatee Trichechus manatus, right whale Eubalaena glacialis, Cumberland Island pocket gopher (endemic) Geomys cumberlanchis, Anastasia Island cotton mouse (endemic subspecies), Blackbeard Island deer (endemic subspecies) St. Simon's Island raccoon (endemic subspecies) and green rat snake (endemic subspecies). Faunal lists: see Johnson et al. (1974) and Hillestad et al. (1975). Gray's Reef hosts rich and varied fish populations; marine turtles and mammals have also been reported from the area.

ZONING/CONSERVATION MANAGEMENT Core areas: Blackbeard Island Wilderness, Sapelo Island National Estuarine Sanctuary, Gary's Reef national marine Sanctuary, Lewis Island Natural Area, Wolf Island National Wildlife Refuge, Cumberland Island National Seashore and offshore 3 miles. Buffer zone: Blackbeard Island National Wildlife Refuge (non-wilderness portion), Richard J. Reynolds State Wildlife Refuge, Altamaha State Waterfowl Management Area, Little St. Simon's Island. Gray's Reef National Marine Sanctuary has an adopted management plan. Sapelo Island National Estuarine Sanctuary has a draft management plan. Cumberland Island National Seashore has a Final General Management Plan. Lewis Island Natural Area: included in proposed plan for the Lower Altamaha River.

STAFF There are approximately 50 staff in the unit

LOCAL ADMINISTRATION Blackbeard Island National Wildlife Refuge and Wolf Island National Wildlife Refuge: Georgia Coastal Complex, U.S. Fish and Wildlife Service, P.O. Box 8487, Savannah, G.A. 31412.
Sapelo Island National Estuarine Sanctuary, R.J. Reynolds Wildlife Refuge: Georgia Department of Natural Resources, Sapelo Island, G.A. 31327.
Gray's Reef National Marine Sanctuary: Office of Ocean and Coastal Resource Management, NOAA/U.S. Dept. of Commerce, 3300 Whitehaven St., N.W. Washington, D.C. 20036.
Lewis Island Natural Area: Altamaha State Waterfowl Management Area, G.A. Dept. of Natural Resources, Darien, G.A. 31305.
Cumberland Island National Seashore: P.O. Box 806, St. Mary's, G.A. 31558.
Little St. Simon's Island: P.O. Box 1096, St. Simon's Island, G.A. 31522.

VISITOR FACILITIES Educational programs for the general public are regular prominent features on Cumberland (run by the National Park Service), Sapelo (run by the Georgia Department of Natural Resources and the University Ga Marine Institute) and Gray's Reef (run by the University Ga Marine Exension Centre at Skidaway Island).

SCIENTIFIC RESEARCH AND FACILITIES The most outstanding feature of this unit is the 30 years of scientific research that has been carried out at the Sapelo Island University of Georgia Marine Institute. There is also a growing commitment to terrestrial barrier island ecology on Cumberland Island and to marine research at Gray's Reef. Short-term monitoring has occurred at Sapelo almost continuously over the last 30 years, but there had been no comittment to long-term monitoring of specific biological, physical or chemical parameters, with the exception of climate. Plans for long-term monitoring are being developed. Some monitoring is being done on Cumberland and Gray's

Reef. Marine turtle nesting is being monitored and data area available for the past 15 years; marine mammals are also monitored, and the state monitors water quality and commercial fisheries production in the Altamaha River, the estuaries and near shore waters. Research facilities are outstanding at Sapelo, with laboratories, library, computer access, research vessels and housing. Cumberland has a small laboratory and dormitory housing. Experimental plots have been established on Sapelo (estuary) and Cumberland (estuary and terrestrial). Research at Gray's Reef takes place principally through the Skidaway Institute of Oceanography, Savannah.

MODIFICATION OF THE NATURAL ENVIRONMENT Most of the proposed reserve was harvested for timber, and much of the acreage was under cultivation during the 19th century. Some buildings do exist, but structures do not dominate the landscape. Pollution levels are low, except for the evidence of paper mill air near the southern end of Cumberland Island. Pollution risks are present from such facilities as the Kings Bay Nuclear Submarine Base west of Cumberland Island.

PRINCIPAL REFERENCE MATERIAL

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Glacier Bay-Admiralty Island Biosphere Reserve

BIOGEOGRAPHICAL PROVINCE 1.01.02 (Sitkan)

LEGAL PROTECTION Relevant to National Parks and National Monument status

DATE ESTABLISHED Approved as a Biosphere Reserve in 1986

GEOGRAPHICAL LOCATION The reserve consists of two separate units, situated on the North Pacific Region, west of Juneau in south-east Alaska, some 65km apart, and bordering onto British Columbia.

ALTITUDE See individual sites

AREA Total area of the combined units is 1,714,851ha, consisting of Glacier Bay National park 1,335,492ha and Admiralty Island National Monument (Wilderness Area) 379,359ha.

LAND TENURE The national park is managed by the National Park Service, and the national monument by the Forest Service.

PHYSICAL FEATURES Glacier Bay is an ice-affected landscape with major tectonic activity, displaying earthquake generated landslides and waves. Admiralty Island includes the complete island in the Alexander Archipelago with pristine reversing waterfalls, lakes and a number of bedrock types. See individual sites.

VEGETATION Glacier Bay National Park has ancient old-growth forests (sitka-spruce western hemlock) in the valleys and successional young forests are developing on the glacier covered areas. Marine ecosystems (fjords). Admiralty Island contains the greatest remaining block of productive old-growth temperate rain forest in the world. See individual sites.

FAUNA Glacier Bay National Park has healthy populations of top carnivores including brown and black bears and at least 13 species of alcid seabirds occur in the area, together with good populations of harbour seals and until recently, humpback whales. Admiralty Island has the highest sustained density of North American brown bear and one of the highest densities of nesting bald eagles. See individual sites.

CULTURAL HERITAGE On Admiralty Island there is a native village of Angoon, whose inhabitants have maintained one of the most intact traditional cultures of the coastal peoples. See individual sites.

ZONING/CONSERVATION MANAGEMENT Glacier Bay has management extending to the ocean waters and bottom of the Bay as well as the outer coastal fringe. Admiralty Island includes the monument and the Young Bay Experimental Forest. There are proposals for a potential Canadian addition to the biosphere reserve on the Alsek River corridor. The general purposes of management at both sites is for ecosystem conservation, baseline study of public recreation (limited on Admiralty Island) and education (in Glacier Bay). See individual sites.

STAFF See individual sites

LOCAL ADMINISTRATION See individual sites

VISITOR FACILITIES Public recreation is to be developed in both units but is to be limited in the case of Admiralty Island.

SCIENTIFIC RESEARCH AND FACILITIES Glacier Bay was used as a research area for the development of many basic concepts of succession in ecology, and the area was established as a national park because of its scientific interest and use. A large summer research effort takes place annually, involving glaciology and glacial geology as well as fisheries, wildlife, marine sciences

and plant ecology. On Admiralty Island the research programme of the Young Bay Experimental Forest has imphasized fisheries habitat work. See individual sites.

LOCAL POPULATION See individual sites

MODIFICATION OF THE NATURAL ENVIRONMENT See individual sites

PRINCIPAL REFERENCE MATERIAL See individual sites for specific references on the units. Biosphere Reserve nomination submitted to Unesco covers the area as one unit.

Glacier Bay-Admiralty Island Biosphere Reserve:
Admiralty Island National Monument (Wilderness Area) Unit

BIOGEOGRAPHICAL PROVINCE 1.01.02 (Sitkan)

LEGAL PROTECTION At time of establishment most of the site was given the status of a wilderness and legislation was provided to address the major management issues.

DATE ESTABLISHED Established by the Alaskan National Interest Lands Conservation Act (ANILCA) of 1980 and approved as a unit of the Glacier Bay-Admiralty Island Biosphere Reserve in 1986.

GEOGRAPHICAL LOCATION Located in south-east Alaska, 24km west of Juneau. The island is bound on the east and north by Stephens Passage, on the west by Chatham Straits, and on the south by Frederick Sound. The island is 124km north to south and 38km east to west. 57°02'-58°11'N, 132°25'W.

ALTITUDE 0-1,432m

AREA 379,359ha is the area of the biosphere reserve unit. The National Monument covers almost 90% of Admiralty Island which is designated a wilderness area and covers 373,005ha which adjoins the Young Bay Experimental Forest at the northern end of the island. The Mansfield Peninsula is excluded.

LAND TENURE Mostly State owned. It is the first and only U.S. national monument under the management of the Department of Agriculture, Forest Service. Three native corporations have titles to Admiralty Island Monument Wilderness - Shee Atika Inc. (9,315ha), Kootznoowoo Inc. (729ha) and Sealaska Inc. (38ha). In addition 558ha is in private lands.

PHYSICAL FEATURES The north of the island is mountainous (1,219-1,432m), rugged and snow covered most of the year. The central area is gentle rolling terrain while the southern portion is again mountainous. There are reversing (tidally driven) waterfalls, many bedrock types, large freshwater lakes, rocky islands, reefs and rock bluffs (Mitchell Bay-Kootznoowoo) and small gravel beaches. Streams on Admiralty are generally larger and longer than those on other southern Alaskan islands. All streams are clear and there are many saltwater bays and estuaries. The climate is dominated by maritime elements with temperatures of 15°C in the summer and around 4°C in the winter. Storms and moderate to heavy rainfall occurs throughout the year, with heaviest precipitation from September to November. Snow cover maybe upto 2.5m deep, and at high elevations upto 5m. Rainfall throughout southern Alaska averages 2540mm annually. Groundwater is however scarce. Soils are thick, moist, have

an organic duff layer and high nutrient content and can be classified into alpine organic, well-drained organic, well-drained organic (over gravel) and wet organic (classified into moss peat soils, sedge peat soils, moderately and poorly decomposed) and muck soils.

VEGETATION The forests represent the largest remaining block of productive old-growth temperate rain-forest in the world. This spruce-hemlock rainforest is interspersed with small areas of muskeg and the timberline is typically at 450 to 600m. Above this the forest grades into alpine-tundra with rock outcrops and permanent to semi-permanent ice fields. There are numerous tidal meadows whilst the muskeg conifer mixtures are plentiful on east Admiralty whilst there is unbroken forest cover in the north and west. The dominant trees are western hemlock Tsuga heterophylla, sitka spruce Picea sitchensis and scattered mountain hemlock Tsuga mertensiana and nootka cypress Chamaecyparis nootkatensis. Alnus sp. is common along streams, beach fringes and recently logged soils. Shrubs include Vaccinium sp., Gaylussacia sp. and devil's club Oplapanax horridus. Mosses are abundant, and bog plant communities are dominated by Sphagnum sp. and Carex sp.

FAUNA Wildlife found on Admiralty include brown bear Ursus arctos (estimated at 1000 individuals, one of the highest concentrations in south-east Alaska), sitka black-tailed deer Odocoileus hemionus sitkensis (densities rated good to high at their northernmost extension), beaver Castor canadensis, marten Martes americana, weasel Mustela ermina, mink Mustela vison and river otter Lutra canadensis. Marine mammals are principally in Seymour Canal, including humpback whale Megaptera novaeangliae, killer whale Orcinus orea, harbour seal Phoca vitulina (up to 300 individuals), Steller's sea lion Eumetopias jubata and Dall's propoise Phocoenoides dalli. Birds include the bald eagle Haliaeetus leucocephalus with a recorded 893 nests along the island's 1,383km coastline. Upland species of blue grouse Dendragopus obscurus, ptarmigan Lagopus lagopus and white-tailed ptarmigan L. leucurus. Waterfowl are also present with Mitchell Bay, Gambler Bay, Pybus Bay and Seymour Canal identified as prime wintering areas. Fish are numerous with specially important species such as pacific salmon Oncorhynchus sp., trout Salmo sp. and char.

CULTURAL HERITAGE The people of the native village of Angoon have maintained one of the most intact traditional cultures of the coastal people's and depend heavily upon the resources of the National Monument for their way of life. Eighty-five cultural sites are recorded for Admiralty Island including aboriginal, non aboriginal and mixed sites. Villages, fish camps, forts, burial places, cemeteries, rock shelters and others have been recorded.

ZONING/CONSERVATION MANAGEMENT 90% of the island is designated wilderness area, with a small area in the north, the Noranda Mine-Mill Site as monument non-wilderness. Other zonations are native selection lands around Angoon village, the Admiralty Lakes Recreation Area, the Shee Atika Corporation-Sitka Urban Native Corporation, the Anaconda Prospect, the Pack Creek Natural Area and Bear Preserve, the Oliver-Inlet State Park and the Seymour Eagle Management Area. At the time of establishment (1980) most of the National Monument was designated for wilderness management under the Forest Service. At present a number of special management designations exist: Admiralty Lakes Recreation Area (44,550ha) which has 43km of fishing streams, 27km of trails, seven cabins and one commercial resort; Pack Creek Research Natural Area (4,455ha) managed as a wildlife viewing area; Seymour Eagle Management Area (4,365ha) with over 100 bald eagle nests, designated in 1972. The three native claims have management plans including roads, timber harvests, aquiculture and developed recreation. The Recreation Opportunity Spectrum

(ROS) inventory system identified areas into four recreation classes from primitive I to semi-primitive (motorized) representing a range of development levels.

STAFF No information

LOCAL ADMINISTRATION Office of Forest Service is located in Angoon. Tongass National Forest Admiralty Monument PO Box 2097, Janeau, Alaska 99803.

VISITOR FACILITIES Access to the area is available by boat or float place from Janeau. There are some 28 special use permit cabins, seven trail cabins and 13 Forest Service recreation cabins (rented at $10/day) and the central part of the island, including Thayer Lake (where there is a commercial lodge) and Hasselborg Lake is designated as the Admiralty Lakes Recreation Area which also includes the Cross Admiralty Canoe Route, a trail system linking eight major lakes. In total there are 40km of trails. The ROS inventory system, provides a framework to manage land and water resource by analysis of outdoor recreation issues, public needs establishing criteria for wilderness management guidelines. In 1981 there were 10,400 recreation visitor days. The Forest Service also maintains a small picnic and campground area near the State ferry terminal and there is a small boat float, which is heavily used in the summer, and a small-craft float and seaplane float in Kootznanoo Inlet. There are two commercial facilities and 25 private cabins also. The Mansfield Peninsula (outside the biosphere reserve) and northern Stephens Passage are most heavily used for hunting, fishing, boating and beach orientated activities. Activities taking place in the monument include hiking, photography, boating, picnicking and camping.

SCIENTIFIC RESEARCH AND FACILITIES The research programme of the Young Bay Experimental Forest has emphasized fisheries habitat work, but only small harvest units are present.

LOCAL POPULATION A Tlingit Indian Village, Angoon, with a population of 500 people lies at the mouth of the Mitchell Bay on the west side of Admiralty Island and adjacent to the wilderness. The community relies heavily on subsistence due to high rates of unemployment (20%) and low family income. The Forest Service is a significant employer, having an office in Angoon, hiring locals and maintaining a Young Adult Conservation Corp.

MODIFICATION OF THE NATURAL ENVIRONMENT Almost all of the ecosystems are in an intact state. Selective felling occurred in the coastal sections at the beginning of the century, and some commercial clearcut units can be found on the east of the island. Forest fires are rare but over 100 years ago a forest fire may have burned over 405ha. In the past coal (600 tons mined at Kanalku Bay) and gold were mined. Presently zinc, silver, lead, copper and gold have been discovered at Greens Creek. Mining in National Forests is guided by the general mining laws of the U.S. and through National Forest Mining Regulations (36 CFR 228). Sections 503 and 504 of ANILCA amended the general mining laws with reference to Admiralty Island.

PRINCIPAL REFERENCE MATERIAL

Anon. (1982). Admiralty Island National Monument. In Draft Management Plan and Environmental Assessment.

Glacier Bay-Admiralty Island Biosphere Reserve
Glacier Bay National Park Unit

BIOGEOGRAPHICAL PROVINCE 1.01.02 (Sitkan)

LEGAL PROTECTION The park area (98%) is totally protected and the preserve

area (2%) allows sport and subsistence hunting and trapping and minor residential use. The park is unique in the U.S. in that the legislation establishes the site game management of the ocean waters and bottom of the bay itself, as well as an outer coastal fringe to the National Park Service.

DATE ESTABLISHED The National Park and Preserve were established under the Alaska National Interest Lands Conservation Act in 1980. The area, together with the Admiralty Island National Monument was approved for biosphere status in 1986. The Glacier Bay National Moument (now in the national park) was established in February 1925 by presidential proclamation.

GEOGRAPHICAL LOCATION Located in south-east Alaska, on the Gulf of Alaska and the north-eastern Pacific Ocean. The centre of the park is approximately 144km north-west of Juneau and about 965km south-east of Anchorage. The park is bounded by the Gulf of Alaska to the west, the Chilkat Range to the east, Cross Sound and Icy Strait to the south and the St. Elias Mountains the Alsek River and the Tongass National Forest to the north. It lies at the north-western end of the Alexander Archipelago. 58°10'-59°15'N, 135°15'-138°40'W.

ALTITUDE 0-4,666m

AREA Glacier Bay National Park has an area of 1,335,492ha comprising 252,000ha saltwater with 1,415km of coastline and the remainder land and freshwater including about 80ha of inholdings.

LAND TENURE The land is largely in government ownership and is managed by the National Park Service. There are three small areas of private holdings, one to the west and two to the east of Gustavus settlement. Two areas, Salmon River 1,360ha and Fall Creek 324ha are potential exchange areas with the State.

PHYSICAL FEATURES The area is a superlative example of the ice affected landscapes typical of the central segment of the Sitkan province, and is characterized by mountain ranges rising to over 4,570m, coastal beaches with protected coves, deep fjords, 16 tidewater glaciers, coastal and estuarine waters and freshwater lakes. As recently as 200 years ago the bay was entirely filled with a glacier and is characterised by high year-round average flows, distinct day-to-night differences in discharge, high silt content in stream water and occasional flooding. The area is sharply dissected and rugged containing three major mountain ranges separated by the 105km-long fjord system of Glacier Bay. The landscape falls into three broad categories: land covered by snow, ice or bare rock (35%); successional vegetation (30%); and more mature vegetation (35%). Marine areas include an inshore portion of the continental shelf, fjord systems of various depths and isolated saltwater bodies or 'salt chucks'. Throughout the deglaciated areas freshwater is abundant in the form of small to medium-size streams and ponds but many drainages are partially or completely blocked by ice. About 20 glacier fronts still meet the sea occasionally. The bedrock geology is complex with a dominant north-west trend in rock belts, with gneiss, biotite schist and hornblende schist the main rocks. Intrusive materials are foliated granite rocks (hornblende diorite) and layered gabbro complexes. The area is considered to be Alaska's highest seismic risk zone. Temperatures range from a January minimum of -5°C (-23°C the extreme temperature) to a July maximum of 17.1°C, precipitation is greatest on the coast at 2870mm and 1390mm inland. Prevailing winds are east-south-east with average annual wind speed 8 to 10 knots.

VEGETATION Four land ecosystems are found in and around the site: wet tundra, coastal western hemlock, sitka spruce forest, alpine tundra and glaciers and icefields. Wet tundra, present near Gustavus, has a ground cover of sedges Cyperaceae and cottongrass Eriophorum sp. with lodgepole pine Pinus contorta, shrubby willow Salix sp. and sitka alder Alnus sp. Coastal western hemlock Tsuga heterophylla and sitka spruce Picea sitchensis occurs along the western and southern edges of the park, mixed with black cottonwood Populus sp. along the streams and on beach fringes with an understorey of moss, blueberry Vaccinium sp., devil's-club Oplopanax horridus, skunk cabbage and ferns. Alpine tundra occurs above 760m and consists of barren rocks and rubble interspersed with woody herbaceous and shrubby blueberry. The glaciers and icefields have snow falls which sometimes persist from one season to the next. Coarse rock material is carried forward in the ice at the glacial front and from spring to winter meltwaters carry rock materials to form terraces and outwash deposits. Surface material deposits form moraines which are invaded by lichen and moss species, horsetail Equisetum sp. willow, fire wed Epilobium sp. and Dryas. These are followed by alder, willow, soapberry Sapindus drummondi and cottonwood. There are nine plant successional stages present in the lowland sites from pioneer through to sub-forest muskeg, and six major mature plant associations (true forest, supratidal meadows/rocky shores and beaches, shrublands/cliffs and gullies, muskeg, alpine meadows and tundra and freshwater marshes). Aquatic associations include freshwater and marine (intertidal zone and neritic environment and estuaries, fjords and upper inlets) with the latter having characteristic flora of Laminaria spp. Alaria spp., Ulva spp., Porphyron spp., Fucus districhus and Nereocystis spp..

FAUNA Twenty-eight terrestrial mammals including wolf Canis lupus, brown bear Ursus arctos middendorffi, black bear U. american, wolverine Gulo gubluscus, river otter Lutra canadensis, Canadian lynx Felis lynx canadensis, black-tailed deer Odocoileus hemionus, moose Alces alces and mountain goat Oreamnos americana. Eight marine mammals including humpback whale Megaptera novaengliae and Steller's sealion Eumetopias jubata. An unsuccessful attempt was made to reintroduce sea otter Enhydra lutris in 1968. 210 recorded bird species but ony 14 sea and 23 land birds can be considered common including the bald eagle Haliaeetus leucocephalus. Over 237 fish species including all five species of Alaskan pacific salmon: chum Oncorhynchus keta, red O. nerka, silver O. kisutch, pink O. gorbuscha and king O. tshawytscha. Marine fish are diverse and include Pacific halibut Hippoglossus stenolepis, Pacific herring Clupea pallasii, Pacific cod Gadus macrocephalus, capelin Mallotus villosus and Pacific sandlance Ammodytes hexapterus. Shellfish include king crab Paralithodes camtschatica, Dungeness crab Cancer magister, tanner crab Chionocecetes spp., shrimp Pandalus and Pandalopsis spp. and butter clam Saxidomus giganteus. The freshwater fish fauna is more limited and includes Dolly Varden Salvelinus malma, cut-throat trout Salmo clarki and three-spined stickleback Gasterosteus aculeatus.

CULTURAL HERITAGE The area has historic interest, having been visited by explorers and scientists since voyagers such as Chirikoff (1741), Cook (1978) and Vancouver in 1794. Muir was responsible for the exploration of the area in 1879. Human occupation has virtually been limited to the sea coast, with the earliest evidence dated 10,000 years BP. The territory in the 18th and 19th century was occupied by the Tlingits who lived in villages and established food gathering camps of which 21 are known. The only permanent settlement in the monument was Listi, in Dundas Bay. Since then sporadic settlements have taken place in connection with mining, pioneering and industrial and fur breeding activities.

ZONING/CONSERVATION MANAGEMENT A mid-channel marine corridor in Glacier Bay is designated for motorized vessels between June 1 and August 31 to protect humpback whales. 82% of the area has been designated wilderness, under the 1964 Wilderness Act. There are the Areas of Special Scientific Interest covering 96,811ha and the following management zoning in the national park is non-wilderness water zone, wilderness lands zone, wilderness water zone, development zone, special use zone, while the preserve has special zones, wilderness zone and natural zone. Management responsibility have needed revision since the area has increased from 1.13 million ha to 1.33 million ha, and its status has changed from a national monument to a national park and preserve. A General Management Plan has been prepared which constitutes the wilderness review as required by ANILCA and is the basis to detailed plans which will include a natural resource management plan, a backcountry management plan, a river management plan and a bear management plan. The aims of management are given as ecosystem conservation baseline study and public recreation and education.

STAFF Fifteen permanent full-time including superintendent, concession specialist, source management specialist, administration officer, chief of operations, chief of maintenance and chief of interpretation and 31 seasonal employees.

LOCAL ADMINISTRATION Superintendent, Glacier Bay National Park and Preserve, Gustavus, AK 99826.

VISITOR FACILITIES There has been a fourfold increase in visitor numbers in the last ten years with 76% arriving by cruise ship and a total visitation of 96,000 in 1983. The area can be reached only by plane or boat, and there are scheduled and charter cruise boats. Details of services and facilities are given in the Glacier Bay Handbook. The Glacier Bay lodge operates from mid-May to mid-September and is situated at Bartlett Cove and there is one campground also at Bartlett Cove. Access to the backcountry is usually by a tour boat.

SCIENTIFIC RESEARCH AND FACILITIES Ten current studies some with university collaboration which include glaciological and sediment, intertidal, visitor use and effects of boat traffic on humpback whale behaviour. The National Park Service offers logistic and communication support to research groups subject to certain requirements. The park office maintains a study collection of 3,500 specimens and a reference library. Many of the basic concepts of succession in ecology were based upon studies and observations in Glacier Bay, a national park system founded because of scientific interest and use. Each year the park hosts a large summer research effort involving many descriptions from glaciology to plant ecology.

MODIFICATION OF THE NATURAL ENVIRONMENT Changes in natural conditions, increasing visitor pressures and changing landuse patterns have created problems. The increase in visitors and number of vessels in Glacier Bay may have affected the numbers of humpback whales, present numbers of which have decreased steadily from 1978. Illegal fishing is taking place in wilderness waters on a commercial basis, although fishing in adjacent waters is allowed and in period 1975-1980, the average annual salmon catch was 2,160,000 pounds valued at $4 million.

PRINCIPAL REFERENCE MATERIAL
Nearly 500 published reference works mainly on glaciological, glacio-geomorphological, geological and oceanographic terrestrial ecosystems, history and anthropology marine and aquatic ecosystems and resource management studies.

Anon. (1982). Statement for management Glacier Bay National Park and Preserve Alaska. Denver Service Centre National Park Service United States Department of the Interior.

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Wood, J.D. (1983). A Century After Muir. The Scientific Adventure. Proceedings of the First Glacier Bay Science Symposium. September 23-26, 1983. Glacier Bay Lodge Glacier Bay National Park and Preserve U.S. Department of the Interior. National Park Service Science Publications Office.

Banados del Este

BIOGEOGRAPHICAL PROVINCE 8.32.11 (Uruguayan Pampas)

LEGAL PROTECTION This area is said to contain some 30,500 ha in National Parks that are governed by law no. 9841 (4 July 1935) concerning the protection of flora and fauna. It is unclear to which areas this refers.

DATE ESTABLISHED June 1976 as a Biosphere Reserve.

GEOGRAPHICAL LOCATION In eastern Uruguay, on the Brazilian frontier; 32°-35°S, 53°-55°W.

ALTITUDE 0-50m

AREA 200,000ha

LAND TENURE 30% state government; 70% privately owned

PHYSICAL FEATURES Four important rivers flow through Banados del Este into the Merim Lagoon; the Yaguaton, Tacuari, Olimar and San Luis. Grey panosol fields, normally under water, produce a great floral variety. The soils are peaty with high acidity. Annual average rainfall in the zone is 1100mm, most abundant in winter, and the temperature ranges between 8°C and 28°C.

VEGETATION This is the only area in the country where the "butia" palms Butia yatay growing in these soils are protected. They form an almost pure association. Dominant in the herbaceous community are Cyperaceae, Juncaceae, Gramineae (Scirpus californicus, Typha spp., Zizaniopsis bonaerensis, Scirpus giganteus etc.). There are also a variety of psammophilous plants and extensive stands of the conifer Pinus atlantica along the coast.

FAUNA The indigenous fauna remains almost intact except that the marsh deer Blastocerus dichotomus is now locally extinct. There are large colonies of coypu Myocastor coypus and capybara Hydrochoerus hydrochoeris, while otter Lutra longicaudis are less abundant. Perhaps more important, however, is the tremendous wealth of avifauna, which includes species such as the red-legged seriema Cariama cristata, black-necked swan Cygnus melanocoryphus, Coscoroba swan Coscoroba coscoroba and muscovy duck Cairina moschata. Black-headed duck Heteronetta atricapilla, snowy egrets Egretta thula, white-faced ibis Plegadio chili, black-winged stilts Himantopus himantopus and brown-hooded gulls Larus maculipennis are all found in the marshes around Merima. In addition, this zone is one of the most important in the southern hemisphere for the study of migratory birds.

ZONING/CONSERVATION MANAGEMENT None

STAFF A small technical staff is available for isolated studies.

LOCAL ADMINISTRATION Presidente, Instituto Nacional para la Preservacion del Medio Amniente, s/c Luis Cavia 3046, Montevideo, Uruguay.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Among the basic problems, concerning which an ambitious plan for research has been undertaken, the following may be mentioned: a) dry-season pastures for the development of stock raising; b) water regulation in periods of flooding and drought; c) control of bird

migration and reintroduction of extinct species; d) epidemiological research into furuncular myiasis. All this ecological research is important for the countries in the temperate zone having wetlands. The whole area of the eastern marshes is provided with a good road network and accommodation facilities for groups of scientists working there.

MODIFICATION OF THE NATURAL ENVIRONMENT The ecosystem is threatened with serious changes as stock raising gradually gives way to rice-growing. Pesticides are now being used and there has been an attempt to dry the lake areas and alter the water levels in the flood zones. Excessive commercial hunting of aquatic mammals for fur has led to a drastic decline in their numbers; uncontrolled tourism is also exerting increasing pressure. The implementation of a plan to channel the lagoons and marshes flowing into the sea would have irreversible consequences for the environment.

PRINCIPAL REFERENCE MATERIAL

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Sombroek, W.G. (1969). Soil studies in the Merim Lagoon basin.
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Réserve Ecologique du Bassin de la Rivière Tara

BIOGEOGRAPHICAL PROVINCE 2.33.12 (Balkan Highlands)

LEGAL PROTECTION Protected by the Plans for Nature Protection.

DATE ESTABLISHED In 1952, the two national parks were formed. Approved as a Biosphere Reserve in June 1976. Accepted as a World Heritage Site in 1980.

GEOGRAPHICAL LOCATION The reserve includes the extreme south-eastern parts of the Dinaric Alps and the northern and north-eastern regions of the Socialist Republic of Montenegro. The Tara Basin is bordered by mountains Bobotov Kuk (2,522m), Sinjajevina (2,203m), Komovi (2,484m), Bjelasica (2,137m) and Ljubisnja (2,238m). 42°32'N, 18°50'-19°45'E.

ALTITUDE 433-2,522m

AREA The Biosphere Reserve covers an area of approximately 200,000ha including Durmitor (32,000ha) and Biogradska Gora (5,000ha) and two virgin forest reserves (2,000ha).

LAND TENURE 60% of the basin is state property and 40% private property.

PHYSICAL FEATURES The geological structure of the Tara basin is formed of Upper Palaeozoic, Triassic, Jurassic, Cretaceous, Tertiary and Quaternary rocks. The upper part of the basin is formed of clastic rocks and the lower generally of mesolithic limestones. The main mineral deposits are lead and zinc near Mojkovac; mercury, copper and other minerals have also been noted. From its source in the Komvoi region to its confluence with the Piva near Scepan Polje, the Tara River is about 150km long. The Tara Basin contains 78 large and small watercourses, about 20 glacial lakes, and a great many major karst springs. The depth of the Tara Canyon exceeds 1,300m in places; the only canyon deeper is the Grand Canyon of the Colorado River in the USA.

VEGETATION Around the source of the Tara and in its upper reaches there are forests of beech Fagetum montanum and virgin forests of mixed beech and fir Fagetum abieostum. In the next part of its course the Tara goes through a deep canyon with a great many vegetation zones ranging from the thermophilic populations of holm-oak forests to alpine-zone populations Pinetum mughii. In the canyon a number of populations are represented on the rocks and scree. Among the conifers, special mention should be made of the black pine Pinus nigra, which is distinguished by its great height and is one of the last virgin black pine forests in Europe. The Tara canyon is a refuge for many endemic kinds of plants and relict plants, such as Edraianthus glisicii, Amphoricarpus autariatus, Daphne malyana, Trifolium durnitoreum, Verbascum durmitoreum, Carum velenovsky, Saxifraga preiya and others.

FAUNA The region around the Tara is distinguished by an interesting and attractive fauna, for instance chamois Rupicapra rupicapra, roe deer Capreolus capreolus, wolf Canis lupus, wild boar Sus scrofa, brown bear Ursus arctos, hare Lepus capensis, fox Vulpes vulpes and wildcats Felis silvestris. There are many bird species: capercaillie Tetrao urogallus, hazel grouse Bonasa bonasia, black grouse T. tetrix, rock partridge Alectoris graeca and different species of the predator family (Accipitridae); owls (Strigidae), falcons (Falconidae), and others. Various species of Salmonidae live in the Tara River.

ZONING/CONSERVATION MANAGEMENT The Tara Basin is divided into two parts, the upper and the lower, of almost equal length. The dividing line comes where

the Bistrica River flows into the Tara. The Lower Tara is especially interesting and attractive in that it is embanked in a deep canyon.

STAFF For the beginning of the work, the plan is to appoint ten technical specialists and scientific workers.

LOCAL ADMINISTRATION Montenegro Socialist Republic, Institute for the Protection of Nature, PO Box 2, Titograd 81001.

VISITOR FACILITIES Hotels and campsites within the park. Marked footpaths. There are no tourist centres in the Tara Basin except for a few establishments at Zanljak. There is a high potential for developing tourism on a vast scale. Kayak and raft excursions are organized, and tourists fish in the river.

SCIENTIFIC RESEARCH AND FACILITIES The complexity of the Tara ecosystems is such that specialists of all sorts (geologists, soil scientists, zoologists, geographers, climatologists, botanists, sylviculturists) will be able to carry out long-term projects. The region offers great opportunities for the organization of scientific and educational excursions and expeditions. No information is available on research facilities.

LOCAL POPULATION 4,000 live within the boundaries of the Durmitor National Park. No information is available for the rest of the Biosphere Reserve.

MODIFICATION OF THE NATURAL ENVIRONMENT Up to the present time construction in the Tara Basin has been very rare, almost insignificant. In the canyon section there is virtually none, so that the Tara has thus far retained its original beauty and natural authenticity. As yet, only a road ending at the Djurdjevica Tara bridge and a flotation facility at the Majkova lead and zinc mines have been built. The Upper Tara Basin has some sawmills, facilities for wood-steeping, and other small installations for the timber industry. There are two major threats. One arises from a lead processing factory, 32km upstream from the canyon. The current holding tanks for storage of waste waters rich in heavy metals are due to fill in 1985. As it is not possible to provide new tanks and as 2,000 workers would lose jobs if the plant were closed down, the government has opted to discharge wastes into the Tara River. A conservation symposium held in Monetenegro declared that if this happens, the river would become biologically dead. The second threat is from a hydro project planned for the gorge. An alternative scheme which would not affect the canyon has been presented by the Yugoslavia Institute for Nature Protection, but the government has not yet responded. In addition to these two threats, there has been reduction of the forested areas because of indiscrimintate felling and indiscriminate building has resulted in the loss of arable land and pasture. Most of the high altitude pastures are grazed by sheep and cattle during the summer. Some of the lakes are draining into subterranean swallow-holes. Fairly heavy investments have been made to protect the Tara River from the waters discharged from the mines.

PRINCIPAL REFERENCE MATERIAL

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The Velebit Mountain

BIOGEOGRAPHICAL PROVINCE 2.17.06 (Mediterranean Sclerophyll)

LEGAL PROTECTION In the Plans for Nature Protection the greatest part of the Mountain is scheduled as a National Park or a Nature Park, with defined core areas which are given complete protection.

DATE ESTABLISHED Accepted as a Biosphere Reserve in October 1977. The core area of Paklenica National park was established in 1949.

GEOGRAPHICAL LOCATION Approximately 70km south-east of Rijeka in the Croatian, coastal mountain region, extending from just south of Senj to the canyon of the Znmanja River. The area is approximately 145km in length and varies from 5-15km in width. 44°15'-45'N, 15°00'-45'E.

ALTITUDE 200-1,757m

AREA 150,000ha

LAND TENURE 99% government owned

PHYSICAL FEATURES Mostly Jurassic limestones with an abundance of karst phenomena characterized by deep fissures, caves and underground channels. Annual precipitation 2000-3000mm (rain, snow), with maximum in October and November.

VEGETATION Forest. Three main areas can be distinguished: coast (0-800m), where the following associations of Carpinetum orientalis croat H-ic, Seslerio ostryetum Ht, Pinetum nigrae submediterraneium Anic, Fagetum croaticum sesleriotosum Ht, can be found; karst zone, with its associations of Fagetum croat. subalpinum Ht, Pinetum mughi croat. Ht, Picetum illyricum subalpinum Ht, Calamagrostis dinaricum Bert, Calamagrostis abietum piceetosum Ht; and the inland areas with associations of Fagetum croat. abietosum Ht, Picetum croat. montanum Ht, Fagetum croat. montanum Ht, Querco-carpinetum Ht, and Sibiraea croatica. Among noteworthy flora are several Velebit endemics, Degenia velebitica, Siberia croatica, Campanula velebitica, Saxifraga velebitica, Aubretia croatia and Aquilega ritaibelli.

FAUNA The most noteworthy mammals in the reserve are the brown bear Ursus arctos, roe deer Capreolus capreolus, wild boar Sus scrofa, fox Vulpes vulpes and brown hare Lepus capensis. The most interesting birds are the griffon vulture Gyps fulous (breeding in the Mala Paklenica core area), golden eagle Aquila chrysaetos, buzzard Buteo buteo, barn owl Tyto alba, whilst several uncommon and characteristic species breeding here, include the rock nuthatch Sitta neumayer, wallcreeper Tichodroma muraria, blue rock thrush Monticola solitarius and the rock partridge Alectoris gracca (in the Tulove Grede-Duboke Jask core area) several reptiles occur in the reserve, including the adder Vipera berus, the rose-horned viper Vipera ammodytes, the grass snake Natrix natrix and lizards.

CULTURAL HERITAGE One of the core areas, the Cipala-Satorina-Mirovo was totally depopulated after World War II and is the site of archaeological remains from palaeomediterranean, Illyrian, Roman and Slav cultures. It is considered to be an ethnological zone and noted for its assemblage of rural architecture.

ZONING/CONSERVATION MANAGEMENT The biosphere reserve has the same boundaries as the Velebit Park Prirode (Nature Park) within which there are 14 core areas which include the Paklenica National Park and 12 other forest, botanical and geomorphological sites, and Zavizan, the major botanical garden formed in 1967 and specializing in subalpine flora. Seven of the core areas are forest reserves, and five are mountainous, karst sites. Two are areas, Mala Paklenica and Crnopac are considered to be 'wilderness areas'. The core areas (Poklenica National Park, 3,717ha) and the 13 other separate protective designations contained within the borders of the nature park, including forests, botanical and geomorphological sites are under a strict protection regime. With the buffer zone there is management for timber production and cattle grazing.

STAFF Thirty experts assigned to protection and maintenance

LOCAL ADMINISTRATION National Park Paklenica, Zadar, Yugoslavia.

VISITOR FACILITIES A lodge has been built in the Paklenica National Park.

SCIENTIFIC RESEARCH AND FACILITIES Research being conducted in the reserve includes projects on geomorphology, caves and phytocenology.

MODIFICATION OF THE NATURAL ENVIRONMENT The buffer zone is used for timber production and for cattle grazing.

PRINCIPAL REFERENCE MATERIAL

Bozicevic, S. (1971). Pecine Paklenice u Juznom Velebitu. JAZU - spearat.

Bralic, I. (1971). Paklenica, geolosko pejsazni elementi Nacionalnog parkaionjegove okoline. Elaborat, Zagreb.

Gryn-Ambroes, P. (1980). Preliminary Annotated lists of Existing and Potentially Mediterranean Protected Areas". An IUCN/UNEP report: UNEP/IG.20/INF.5.

Kevo, R. (1961). Nacionalni park "Paklenica" iz Zastita prirode u Hrvatskoj' Republicki zavod za zastitu prirode, Zagreb.

Poljak, Zeljko, et al. (1969). Velebit. Inst. for Nat. Protection, Zagreb.

Rados, D. (1972). Paklenica - vodic, Nacionalni park Paklenica, Starigrad. Paklenica.

Réserve floristique de Yangambi

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION Strict forest reserve; part of the State Botanical Forest at Yangambi Station, National Institute for Agronomic Study and Research (Institut National pour l'Etude et la Recherche Agronomique, INERA)

DATE ESTABLISHED Accepted as a Biosphere Reserve in June 1976

GEOGRAPHICAL LOCATION West of Kisangani on the north bank of the Zaire River. 0°00'-0°40'N, 24°00'-25°00'E.

ALTITUDE No information

AREA 250,000ha

LAND TENURE Government

PHYSICAL FEATURES Relatively flat terrain with tropical red (ferrous) soils

VEGETATION Dense semi-deciduous rain forests

FAUNA Hippopotamus Hippopotamus amphibius, bongo Tragelaphus euryceros, sitatunga T. spekei, elephant Loxodonta africana (V), and several species of monkey occur.

ZONING/CONSERVATION MANAGEMENT The reserve contains a strict core zone and a monitored floristic zone.

STAFF At present, there is a chief of the Botanic and Forestry Office assisted by 30 technical personnel.

LOCAL ADMINISTRATION Direction Générale de l'Institut National pour l'Etude et la Recherche Agronomique (INERA), BP 1513, Kisangani.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES Yangambi Station has an up-to-date herbarium which could serve as a nucleus for other studies.

MODIFICATION OF THE NATURAL ENVIRONMENT Some villages have been established, so there is traditional agriculture and hunting.

PRINCIPAL REFERENCE MATERIAL
None listed

Réserve forestiére de Luki

BIOGEOGRAPHICAL PROVINCE 3.02.01 (Congo Rain Forest)

LEGAL PROTECTION Hunting and fishing are prohibited. There has been no tree was felling since 1963.

DATE ESTABLISHED Forest reserve since 1937, but total protection of the trees only operational since 1963. Accepted as a Biosphere Reserve in May 1979.

GEOGRAPHICAL LOCATION Situated in Bas Zaire, north of the Zaire River, about 150km from the Atlantic coast. 5°35'S, 13°10'E

ALTITUDE 160-350m

AREA 33,000ha

LAND TENURE Government

PHYSICAL FEATURES The bedrock is mainly gneisses and schists of the Mayumbe system and the area is drained by the Luki River and a dense network of tributaries. Mean annual precipitation is 1163mm, but very variable. Mean annual temperature is 24°C.

VEGETATION Much of the area has sub-equatorial rain forest, now mainly disturbed and secondary, but still diverse. The main forest types represented include high forest dominated by Gilbertiodendron and Gossweilerodendron; various secondary formations occur, especially of Terminalia superba; and there is some savanna.

FAUNA The varied fauna includes elephant Loxodonta africana (T).

ZONING/CONSERVATION MANAGEMENT No information

STAFF About 70

LOCAL ADMINISTRATION Forest Reserve of Luki, INERA - Luki Station, Bomna, Bas.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH FACILITIES The region has been the subject of considerable study. There are no proposals for new research at present, but management has been passed to INERA so that research on tropical silviculture can be carried out.

MODIFICATION OF THE NATURAL ENVIRONMENT The area was severely logged until 1963. A small area is cultivated.

PRINCIPAL REFERENCE MATERIAL

Baeyens (1938). Les sols de l'Afrique Centrale, spécialement du Congo Belge. Tome 1 - de Bas-Congo. Publication INEAC, out of print.

Cahen, L. (1954). La géologie du Congo Belge. Vaillant Carmanne, Liège.

Donis, C. (1948). La forêt dense congolaise et l'état actuel de sa sylviculture. Bull. Agricole du Congo Velge 2: 261-320.

Donis, C. and Maudoux, E. (1951). Sur l'uniformisation par le haut. Publ. INEAC, scientific series. No. 51.

Katembo Wanzou (1974). Observations phénologiques sur quelques essences forestières importantes du Mayumné à Luki.

Lebrum, J. and Gilbert, G. (1954). Une classificatioon écologique des forêts du Congo. Publ INEAC, scientific series No. 63.

Meulemberg (1949). L'introduction à l'etude pédologique des sols du Bas-fleuve (Congo-Belge). Bruxelles.

Mutoji, A. and Kazadi (1974). La cartographie forestière de la réserve forestière de Luki. INERA, Mayumbé.

Paelink (1958). Note sur l'estimation du volume des peuplements à Terminalis superbas au Mayumbé, à l'aide des photos aériennes. Bull. Agricole du Congo Belge 44(4): 1045-1054.
Wagemans (1961). Aménagement des forêts dense par la méthode sylvo-agricole à base de plantation de bananiers. Expérience à Luki et au Mayumbé. INEAC, Bruxelles.
Wilten, W. (1955). Aspect de la sylviculture au Mayumbé. Bull. Agricole du Congo Belge 46(2): 319-328.
Woodlti, R. (1954). Introduction à la photogéologie. Bull. Agricole du Congo Belge 45(b): 1429-1472.

Vallée de la Lufira

BIOGEOGRAPHICAL PROVINCE 3.06.04 (Congo Woodland/savanna)

LEGAL PROTECTION Within Kundelungu National Park

DATE ESTABLISHED June 1982 approval as a Biosphere Reserve

GEOGRAPHICAL LOCATION The reserve is located within Kundelungu National Park in the Katanga District of Zaire, near the town of Likasi in south Zaire. 10°55'-11°00'S, 26°50'-27°00'E.

ALTITUDE 1,200m

AREA 14,700ha with a core area of 2,800ha

LAND TENURE Government

PHYSICAL FEATURES The Lufira Valley consists of a series of fluvial morphological features. The river rises in the hills near the southern border of Zaire and is dammed up near its source to form a lake known as the Lac de la Retenue. Thereafter, it flows through a wide valley with traces of lacustrine deposits. Being very flat, the river meanders, forms marshes in the wet season, and often lies above the ground level embanked by alluvial levées. The Lufira then cuts through the high plateaux of Kundelungu to the East and Manika to the West, forming deep gorges, before it flows into lake Kisale, where it is joined by other tributaries and becomes one of the headwaters of the River Zaire. The average annual temperatures vary between 16°C and 31°C; rainfall averages 726mm per year.

VEGETATION The region is characterised by miombo vegetation dominated by Cassia singueana, Psorospermum febrifugum and Afzelia quanzensis with a grass layer. The valley itself consists of aquatic grasslands with Leersia spp., Oryza spp., and Vossia spp., and reedbeds Typha spp. and Phragmites, which are periodically flooded in the rainy season. These reedbeds cover almost 95% of the shallow Lac de la Retenue. There are also gallery forests along parts of the river, with species such as Khaya nyasica, Chlorophora excelsa and Parkia sp..

FAUNA Mammals include: the lechwe Kobus leche and a few elephant Loxodonta africana (T). Reptiles include Varanus niloticus. The area is particularly remarkable for its water birds. A list of bird species is on file at the Division of Ecological Sciences.

ZONING/CONSERVATION MANAGEMENT There is a core area of 2,800ha and an experimental zone of 6,800ha, but there is no further information about these.

STAFF There is a total staff of about 30; two for management, 15 wardens engaged in protection, and about ten research workers.

LOCAL ADMINISTRATION Réserve de la Biosphère Vallée de la Lufira, BP 736 Likasi, Shaba.

VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES A considerable amount of fundamental research has been made on the climate, the hydrography and hydrology, soil characteristics, and composition of plant communities, including plankton.

MODIFICATION OF THE NATURAL ENVIRONMENT The entire region has been considerably modified by man through: overgrazing, particularly by cattle; tree felling for wood fuel and charcoal; infilling of the artificial lake by organic deposits which causes the water level to rise and an increase in evaporation rate; fishing by the population that live by the lakeside; and bush fires.

PRINCIPAL REFERENCE MATERIAL

Duvigneaud, P. (1959). Forêts claires: Composition floristique, classification, affinitès et dynamisme des peuplements. CSA/CCTA Publication 52: 115-121.

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Malaisse, F., Freson, R., Goffinet, G. and Malaisse-Mousset, M. (1975). Litter fall and litter breakdown in Miombo. In: Golley, F.B. and Medina, E (Eds.). Tropical Ecological Systems: Trends in Terrestrial and Aquatic Research. Springer-Verlag, Berlin. 137-152.

BIOSPHERE RESERVE SURVEY

The Scientific Advisory Panel for Biosphere Reserves which has been established in 1985 in accordance with a recommendation of the Action Plan for Biosphere Reserves has drawn up the following questionnaire in order to obtain up-to-date information on the status of each Biosphere Reserve for incorporation into the MAB information system. The answers will help identify programme priorities and opportunities for improving the effectiveness of the Biosphere Reserve network.

The questionnaire should also provide a useful tool for MAB National Committees and for Biosphere Reserve managers to make a self appraisal of their own reserve(s) and to stimulate them to improve their status and functioning.

Kindly fill in the present questionnaire as soon as possible so that it be returned to the MAB Secretariat, c/o Unesco, Place de Fontenoy, 75700 Paris, France, preferably by the 31 July 1986.

BIOSPHERE RESERVE SURVEY

Country:

Name of Biosphere Reserve:

PURPOSE OF THE BIOSPHERE RESERVE

The Action Plan idenfities nine objectives relating to the multiple purposes of Biosphere Reserves. Please CHECK on the following list each of the purposes that applies to your Biosphere Reserve. Then, on the scale provided, CIRCLE A NUMBER that indicates how important that purpose is in the Biosphere Reserve. Circling number five (5) means that it is a primary purpose and that a major portion of available financial resources and/or staff is being used to achieve it. Circling number one (1) means that the purpose is a minor one and that a negligible portion of available resources is being used to achieve it.

The biosphere reserve is intended to: (Check the purposes that apply)	How important is this purpose? (Please circle)				
( ) Conserve natural or minimally disturbed representative ecosystems	5	4	3	2	1
( ) Provide legal and administrative basis for resource protection and management	5	4	3	2	1
( ) Conserve genetic resources in situ	5	4	3	2	1
( ) Conduct experimental problem-oriented research	5	4	3	2	1
( ) Conduct long-term environmental monitoring	5	4	3	2	1
( ) Promote regional planning and integrated rural development	5	4	3	2	1
( ) Promote local participation in planning and management	5	4	3	2	1
( ) Promote environmental education and training	5	4	3	2	1
( ) Communicate information about biosphere reserves, and develop a centre for generating and sharing knowledge on conservation and management	5	4	3	2	1

B. STATUS OF THE CORE AREA(S)

Under the Action Plan each Biosphere Reserve includes one or several core areas, covering one or more examples of natural or minimally disturbed ecosystems, of centres of endemism or of features of exceptional scientific interest. The core area is normally a strictly protected area.

1. The following statements describe possible situations of the core area(s) in this particular Biosphere Reserve. Please CHECK the statements which apply.

( ) The core area(s) has strict protection and management regulations which are duly implemented

( ) The core area contains one or more complete catchment basins

( ) The core area(s) WAS NOT already protected when the Biosphere Reserve was established

( ) The core area(s) covers part of a larger previously protected area (eg: national park)

( ) The core area(s) coincides exactly with a previously protected area (eg: national park, nature reserve)

( ) The protection of the core area(s) is largely ensured by its remoteness

( ) The effective protection of the core area(s) cannot presently be fully ensured

( ) The core area(s) has not yet been recognized

2. If the core area(s) covers all or part of a previously protected conservation area (eg. national park, nature reserve, etc...) please give the official name of this protected conservation area:

_____

3. While the core area is meant to be strictly protected, certain activities might be occuring or allowed. If this is the case please CHECK from the following list those activities that apply to the core area of your Biosphere Reserve:

( ) Collection of plant materials

( ) Ecological observations and surveys

( ) Environmental education

( ) Fishing or shellfishing

( ) Hunting or trapping

( ) Long-term environmental monitoring

( ) Professional training

( ) Public recreation

Economic uses of non-renewable resources. Please specify:

( ) _____
( ) _____

Economic uses of renewable resources. Please specify:

( ) _____
( ) _____

Subsistence activities by indigenous people. Please specify:

( ) _____
( ) _____

Other activities. Please describe:

( ) _____
( ) _____

( ) Please list any of the above activities you regard as a significant adverse influence on the core area?_____

_____

_____

_____

C. STATUS OF THE BUFFER AND TRANSITION ZONES

The core area(s) of a Biosphere Reserve is surrounded by a series of areas serving several functions and all acting as a protective buffer. In these areas a range of human activities may take place. They may include areas suitable for experimental manipulative research aimed at defining and demonstrating methods of sustainable resource development; examples of harmonious landscape resulting from traditional land use; examples of modified or degraded ecosystems suitable for restoration; etc...

1. The first area around the core area(s) is the buffer zone. It is usually delineated (eg. national park, national forest, etc...). The following statements describe possible buffer zone situations. Please CHECK the statement which best describes the buffer zone of your Biosphere Reserve.

( ) A legally delineated buffer zone subject to specific restrictions on allowable uses and under the same administration as the core area(s)

( ) A legally delineated buffer zone subject to specific regulations under a different administration from the core area(s)

( ) A legally delineated experimental research area subject to specific regulations

( ) A mixture of an undelineated area around the core area(s) and one or more delineated experimental research or management areas (cluster biosphere reserve)

( ) An undelineated area with limited human activities

( ) The buffer zone is presently lacking (ie: core area only)

( ) Other (Please describe)_____

_____

2. A transition zone normally surrounds the delineated buffer zone. In this usually undelineated zone, which constitutes the area of influence of the Biosphere Reserve, a number of uses and activities may be occuring or allowed. Please CHECK from the following list those activities that apply to the transition zone of your Biosphere Reserve, or which occur outside the Biosphere Reserve but within a few kilometers from the delineated core, buffer and research areas. Then CIRCLE a number that indicates how important the use or activity is in the region. Circling number five (5) means that the use or activity is dominant or very significant, and has an important effect on the value of the biosphere reserve for conservation and research. Circling number (1) means that the use or activity is minor and has no effect on the value of the biosphere reserve for conservation and research.

These uses and activities occur in the transition zone or within a few km from the delineated areas: (Check those that apply)	How important is this use or activity? (Please rank)
( ) agricultural activities	5 4 3 2 1
( ) agroforestry projects	5 4 3 2 1
( ) fishing or shellfishing	5 4 3 2 1
( ) dredging/filling	5 4 3 2 1
( ) grazing	5 4 3 2 1
( ) human settlements	5 4 3 2 1
( ) hunting	5 4 3 2 1
( ) industrial development	5 4 3 2 1
( ) land conversions	5 4 3 2 1
( ) marine products/aquaculture	5 4 3 2 1
( ) mining of coal or minerals	5 4 3 2 1
( ) oil and gas development	5 4 3 2 1
( ) poaching	5 4 3 2 1
( ) recreational activities	5 4 3 2 1
( ) residential development	5 4 3 2 1
( ) shoreline stabilization	5 4 3 2 1
( ) subsistence activities	5 4 3 2 1
( ) timber production	5 4 3 2 1
( ) tourist development	5 4 3 2 1
( ) transportation facilities	5 4 3 2 1
( ) urban centres	5 4 3 2 1
( ) water developments projects	5 4 3 2 1
other (please specify)	
( ) _____	5 4 3 2 1
( ) _____	5 4 3 2 1
( ) _____	5 4 3 2 1

If you checked agricultural activities, please list the crops currently in cultivation.

_____

_____

If you checked grazing, please list the types of domestic livestock or native wildlife currently being managed.

_____

_____

Please use the space below to provide additional information on any of the above:

_____

_____

_____

D. MANAGEMENT AND ADMINISTRATION

Because of its multiple functions, the Biosphere Reserve should normally have specific arrangements for management and administration.

1. Below are listed some statements concerning the on-site management of your Biosphere Reserve. Please CHECK those statements which apply.

( ) an on-site management authority exists and is implementing a management plan which takes specific account of the objectives of the Action Plan for Biosphere Reserves

( ) an on-site management authority exists but has not yet drawn up a management plan for the Biosphere Reserve

( ) an on-site management body will be set up in the near future

( ) no local management body is planned

2. The on-site management authority normally has links with other bodies in order to fully develop the Biosphere Reserve functions. Please check the links which apply to your Biosphere Reserve:

( ) the MAB National Committee of your country

( ) the administrative authorities responsible for the planning and development of the region

( ) the local community and the representatives of the population living in or around the Biosphere Reserve

( ) scientific institutions involved in basic or applied natural resources research or monitoring

( ) national or foreign botanical and zoological gardens

( ) the management authorities of other Biosphere Reserves in your country

( ) the management authorities of Biosphere Reserves in other countries

3. It is important that visitors and local population be made aware of the status of the area as a Biosphere Reserve. Please CHECK the actions which have been taken for such recognition:

( ) Dedication ceremony
( ) Entrance signs or plaque
( ) Establishment of an on-site research station
( ) Brochure or audio-visual material
Other (please specify)
( ) _____
( ) No recognition yet, but recognition is planned
( ) No recognition planned

Biosphere Reserves require technical and financial support for their proper management and for addressing interrelated environmental, land use and socioeconomic development problems. Please CHECK the statements in the below list which apply to your Biosphere Reserve.

( ) Activities are receiving support from a variety of national sources including a central administrative authority

( ) Activities are receiving support from a single central administrative authority

( ) Activities are supported solely by the local administrative authority

( ) Activities are receiving special assistance from the local population. Please specify:_____

( ) Activities are receiving support from international sources. Please list the international sources (Unesco, UNEP, FAO, IUCN, WWF, etc...) and the projects they support:_____

_____

_____

E. LOCAL POPULATION AND PARTICIPATION

1. The local population living in and around the biosphere reserve can best be described as (CHECK those that apply):

( ) Agricultural
( ) Artisanal fishing/shellfishing
( ) Hunter-gatherer
( ) Nomadic
( ) Pastoral
( ) Urban or suburban
Other (please specify):
( ) _____

2. If indigenous populations live within or near the biosphere reserve, please provide a brief description of these populations below:

_____

3. Approximately how many people live permanently within the buffer zone? _____

4. The Biosphere Reserves should normally provide <u>benefits to people</u> living in and around it.

The below list identifies various potential benefits. Please place a CHECK in the space to the left of each category of benefits that applies in your biosphere reserve. Then, place a CHECK in the appropriate column to the right to record whether the benefits associated with the biosphere reserve are major or minor. A major benefit is one having substantial economic return or associated with significant improvement in the well being of most of the local population. A minor benefit is associated with limited economic return or improvement in well being for a small portion of the population.

		Major Benefit	Minor Benefit
( )	employment opportunities	( )	( )
( )	educational and training opportunities	( )	( )
( )	financial incentives and benefits	( )	( )
( )	health and community services	( )	( )
( )	rural development assistance	( )	( )
( )	tourism and recreational opportunities	( )	( )
( )	soil and water conservation	( )	( )
( )	maintenance of traditional cultures and practices	( )	( )
( )	participation in the planning and management of the Biosphere Reserve	( )	( )
( )	Other. Please specify _____	( )	( )

( ) There are virtually no benefits for local people

CONSERVATION

Biosphere reserves may serve a wide range of conservation purposes.

Please CHECK all the below purposes that apply particularly to your biosphere reserve.

( ) Conserving a representative ecological area in natural or minimally disturbed state

( ) Conserving azonal ecosystems and interface areas (wetlands, coastal areas, etc...)

( ) Conserving large predators

( ) Conserving large, wide-ranging herbivores

( ) Conserving endangered or threatened "Red Book" animal or plant species*

( ) Conserving endangered or threatened species or sub-species identified at the national or regional level

( ) Conserving wild relatives of economic species*

( ) Conserving traditional agricultural cultivars or animal domesticates within indigenous production systems*

( ) Conserving an harmonious landscape resulting from traditional patterns of land use

( ) Conserving biological diversity in managed ecosystems

( ) Reestablishing indigenous species in areas where they have been eradicated or have otherwise disappeared

Other. Please specify:

( ) _____

( ) _____

* If readily available, PLEASE PROVIDE A LIST OF THESE SPECIES

G. RESEARCH AND MONITORING

1. The development of an integrated programme of monitoring and research is a primary function of Biosphere Reserves. CHECK all statements below that apply to your Biosphere Reserve.

( ) The biosphere reserve has an integrated programme of basic and applied research which supports site management objectives and sustainable conservation in the region.

( ) The biosphere reserve has a basic research programme not oriented to land use and management issues.

( ) The biosphere reserve has an applied research programme oriented to land use and management issues.

( ) The biosphere reserve participates in comparative monitoring or research with another biosphere reserve or research site in the same biogeographical province*

( ) The biosphere reserve participates in comparative monitoring or research with a biosphere reserve or research site in another biogeographical province*

( ) The biosphere reserve is the site of a Unesco MAB Project*

( ) The biosphere reserve is used occasionally for research, but has no permanent monitoring and research programme

( ) The biosphere reserve has no research history, and no monitoring and research programme

Approximately how many national scientists have participated in research at the site during the past year? _____

Approximately how many foreign scientists have participated in research at the site during the past year? _____

* Please indicate the research topic and, where applicable, the name of the cooperating site.

_____

_____

_____

_____

Research activities may relate to the various functions of the Biosphere Reserve, including in particular the sustainable development of ecosystem resources. Research priorities and status vary from case to case.

Please record the status of each of the below research topics by placing a CHECK in the appropriate column or columns to indicate whether the research is ongoing, planned as part of your Biosphere Reserve's research programme during the next five years.

	Ongoing Activity	Planned Activity
acidic deposition	( )	( )
agricultural research	( )	( )
appropriate rural technology	( )	( )
biological survey and collection	( )	( )
biogeochemical cycles	( )	( )
comparative ecological research	( )	( )
cultural anthropology	( )	( )
ecological succession	( )	( )
ecosystem modelling	( )	( )
ecosystem restoration	( )	( )
effects of atmospheric pollutants	( )	( )
effects of water pollutants	( )	( )
effects of pesticides	( )	( )
ethnobiology	( )	( )
exotic species	( )	( )
fire history and effects	( )	( )
forest research	( )	( )
genetic resources management	( )	( )
hydrological cycle	( )	( )
limnology and hydrobiology	( )	( )
mining reclamation studies	( )	( )
pests and diseases	( )	( )

rangeland management	( )	( )
rare/endangered species	( )	( )
recreation/tourism impacts	( )	( )
resource mapping	( )	( )
sedimentation	( )	( )
soil studies and conservation	( )	( )
traditional land use systems	( )	( )
watershed management	( )	( )
wildlife population dynamics	( )	( )
Other please specify		
_____	( )	( )
_____	( )	( )

EDUCATION AND TRAINING

Please record the status of each of the below activities by placing a CHECK under the appropriate column or columns to indicate whether the activity is ongoing, planned within the next five years, or both. If no activity, CHECK the last column.

	Ongoing Activity	Planned Activity	No Activity
Environmental education for school children and students	( )	( )	( )
Extension services for local people	( )	( )	( )
Demonstration projects in land use and management	( )	( )	( )
Graduate and postgraduate research projects for students	( )	( )	( )
Interpretive programmes for tourists	( )	( )	( )
Professional training and workshops for scientists	( )	( )	( )
Professional training and workshops for resource managers and land use planners	( )	( )	( )
Training for staff in biosphere reserve management	( )	( )	( )
Training for local people in biosphere reserve concepts and management	( )	( )	( )
Other. Please specify.			
_____	( )	( )	
_____	( )	( )	

I. ON-SITE STAFF AND FACILITIES

In the below listing, CHECK entries which apply within your biosphere reserve.

( ) Air pollution monitoring station

( ) Climatological monitoring station

( ) Conference/meeting facilities

( ) Hydrological monitoring station

( ) Laboratory facility

( ) Library

( ) Lodging for visiting scientists. How many? _____

( ) Microcomputers. Make/model_____

Other computers. Make/model_____

( ) Permanent monitoring plots. How many? Vegetation_____
Lake/stream _____ Marine benthic communities_____
Other (please specify)_____

( ) Road access to research sites

( ) Small watershed integrated research sites. How many? _____

( ) Storage and curatorial facilities for biological and environmental collections

( ) On-site permanent research staff. How many? _____
University-trained staff _____ Technicians _____

( ) On-site administration staff (all staff except for research staff). How many? University-trained staff _____ Other _____

( ) On-site protection staff (wardens, etc...). How many? _____

BASIC RESOURCE INFORMATION

In the below listing, CHECK the types of information which are available for the Biosphere Reserve. After some of the items in the list, space is provided for you to estimate, if possible, the approximate period of record for the type of information.

( ) aerial photographs (_____ years)

( ) acidic deposition data (_____ years)

( ) air quality data (_____ years)

( ) aquatic ecosystems, freshwater (_____ years)

( ) aquatic ecosystems, marine (_____ years)

( ) bibliography

( ) climatological data (_____ years)

( ) ethnobiological information

( ) geological map

( ) history of scientific study

( ) hydrological data, surface (_____ years)

( ) hydrological data, groundwater (_____ years)

( ) inventory of mammals (_____ years)

( ) inventory of other vertebrates (_____ years)

( ) inventory of invertebrates (_____ years)

( ) inventory of vascular plants (_____ years)

( ) inventory of nonvascular plants (_____ years)

( ) land use history (_____ years)

( ) land use map

( ) soils map and description

( ) topographic map

( ) vegetation map

( ) vegetation data (_____ years)

( ) water quality data (_____ years)

( ) other baseline information and data. Please specify:_____

_____

_____

_____

RESPONDENT

Name of respondent: _____

Position: _____

Address: _____

_____

_____

Telephone: _____

Highest academic degree: _____

Professional background: _____

_____

Number of years associated with the Biosphere Reserve: _____

MAILING ADDRESS FOR ADDITIONAL INFORMATION ON THE BIOSPHERE RESERVE (if different from the respondent)

Name: _____

Position: _____

Address: _____

_____

Telephone: _____

Thank you for your time and effort spent completing this questionnaire. Please return the questionnaire as soon as possible so that it reaches the MAB Secretariat preferably by 31 July 1986.

The results of our analysis should give a clear view of the present state of the international network of Biosphere Reserves and could provide you with ideas and suggestions from what is going on in various parts of the world.

If you would like a copy of the results of our analysis, please check the box below.

( )

ENQUETE SUR LES RESERVES DE LA BIOSPHERE

Le groupe scientifique consultatif sur les réserves de la biosphère, établi en 1985 selon une recommandation du Plan d'action pour les Réserves de Biosphère, a préparé le questionnaire suivant afin d'obtenir des informations à jour sur la situation de chaque Réserve de la Biosphère pour les incorporer dans le système d'information du MAB. Les réponses aideront à identifier les priorités de programme et les possibilités d'amélioration du réseau de Réserves de la Biosphère.

Ce questionnaire devrait également constituer un instrument utile aux Comités nationaux du MAB et aux responsables des Réserves de la Biosphère pour effectuer une évaluation de leurs propres réserves et pour les inciter à améliorer leur situation et leur fonctionnement.

Nous vous remercions de bien vouloir remplir le questionnaire ci-joint aussitôt que possible de façon à ce qu'il parvienne au Secrétariat du MAB, c/o Unesco, Place de Fontenoy, 75700 Paris (France) de préférence avant le 31 juillet 1986.

ENQUETE SUR LES RESERVES DE LA BIOSPHERE

Pays:

Nom de la Réserve de la Biosphère:

A. OBJECTIFS DE LA RESERVE DE LA BIOSPHERE

Le Plan d'action pour les Réserves de la Biosphère définit neuf objectifs correspondant à leurs fonctions multiples. Veuillez COCHER sur la liste ci-dessous chacun des objectifs applicables à votre Réserve de la Biosphère. Veuillez ensuite ENTOURER UN CHIFFRE indiquant l'importance de cet objectif dans la réserve. Entourer le chiffre 5 signifie qu'il s'agit d'un objectif principal et qu'une part importante des ressources financières et du personnel disponibles lui est affectée. Entourer le chiffre 1 signifie que l'objectif est d'importance secondaire et qu'une fraction négligeable des ressources disponibles lui est affectée.

La Réserve de la Biosphère est destinée à: (Cochez les objectifs applicables)	Quelle est l'importance de cet objectif? (Entourez un chiffre)
( ) Conserver des exemples représentatifs d'écosystèmes naturels ou très peu perturbés	5 4 3 2 1
( ) Fournir une base juridique et administrative à la protection et à la gestion des ressources	5 4 3 2 1
( ) Conserver les ressources génétiques in situ	5 4 3 2 1
( ) Effectuer des recherches expérimentales axées sur des problèmes concrets	5 4 3 2 1
( ) Effectuer une surveillance continue à long-terme de l'environnement	5 4 3 2 1
( ) Encourager l'aménagement du territoire et le développement rural intégré	5 4 3 2 1
( ) Favoriser la participation locale dans la planification et la gestion du milieu	5 4 3 2 1
( ) Promouvoir l'éducation et la formation relatives à l'environnement	5 4 3 2 1
( ) Diffuser des informations sur les réserves de la biosphère et constituer un centre de développement et d'échange des connaissances sur la conservation et la gestion	5 4 3 2 1

B. **SITUATION DE L'AIRE CENTRALE**

Selon le Plan d'action, chaque Réserve de la Biosphère comporte une ou plusieurs aires centrales, abritant un ou plusieurs exemples d'écosystèmes naturels ou très peu perturbés, de centres d'endémisme ou de sites d'intérêt scientifique exceptionnel. En principe, l'aire centrale est une zone strictement protégée.

1. Les énoncés suivants décrivent les situations qui peuvent se présenter dans l'aire centrale de votre Réserve de la Biosphère. Veuillez COCHER les énoncés applicables.

( ) L'aire centrale bénéficie d'une protection stricte et de dispositions régissant sa gestion qui sont effectivement appliquées

( ) L'aire centrale comporte un ou plusieurs bassins versants entiers

( ) L'aire centrale n'était pas déjà protégée quand la Réserve de la Biosphère a été établie

( ) L'aire centrale fait partie d'une zone déjà protégée plus étendue (ex: parc national)

( ) L'aire centrale coïncide exactement avec une zone déjà protégée (ex: parc national, réserve naturelle)

( ) La protection de l'aire centrale est essentiellement assurée par la difficulté d'accès

( ) La protection effective de l'aire centrale ne peut pas être pleinement assurée à l'heure actuelle

( ) L'aire centrale n'a pas encore été définie

2. Si l'aire centrale (ou les aires centrales) couvrent toute ou partie d'une zone de conservation déjà protégée (ex: parc national, réserve naturelle, etc...), veuillez donner le nom officiel de cette zone protégée:

_____

3. Bien que l'aire centrale soit destinée à une protection stricte, certaines activités peuvent y avoir lieu ou y être permises. Si tel est le cas, veuillez COCHER sur la liste suivante les activités qui s'appliquent à l'aire centrale de votre Réserve de la Biosphère:

( ) Collecte de produits végétaux

( ) Observations et enquêtes écologiques

( ) Education relative à l'environnement

( ) Pêche ou collecte de coquillages

( ) Chasse ou piégeage

( ) Surveillance à long terme de l'environnement

( ) Formation professionnelle

( ) Loisirs

Utilisation économique de ressources non-renouvelables. Prière de préciser:

( ) _____

( ) _____

Utilisation économique de ressources renouvelables. Prière de préciser:

( ) _____

( ) _____

Activités de subsistance de la population indigène. Prière de spécifier:

( ) _____

( ) _____

Autres activités. Prière de décrire:

( ) _____

( ) _____

( ) Veuillez énumérer celles des activités ci-dessus qui ont à votre avis une influence adverse notable sur l'aire centrale:

_____

_____

_____

C. SITUATION DE LA ZONE TAMPON ET DE LA ZONE DE TRANSITION

L'aire centrale d'une Réserve de la Biosphère est entourée d'une succession d'aires jouant plusieurs rôles et servant toutes de tampon de protection. Dans ces aires, un certain nombre d'activités humaines peuvent se dérouler. Elles peuvent ainsi comporter des zones de recherche expérimentale destinées à mettre au point et à démontrer des méthodes de mise en valeur durable des ressources; des exemples de paysages harmonieux résultant de pratiques traditionnelles d'utilisation des terres; des exemples d'écosystèmes transformés ou dégradés se prêtant à la restauration; etc...

1. La première aire autour de l'aire centrale est la zone tampon. Elle est généralement délimitée (ex: parc national, forêt domaniale, etc...). Les énoncés suivants décrivent des situations possibles pour la zone tampon. Veuillez COCHER l'énoncé qui décrit le mieux la zone tampon de votre réserve de la biosphère.

   ( ) Une zone tampon juridiquement délimitée soumise à des restrictions spécifiques quant aux utilisations permises et placée sous la même administration que l'aire centrale

   ( ) Une zone tampon juridiquement délimitée soumise à une réglementation spécifique et placée sous une administration différente de celle de l'aire centrale

   ( ) Une zone de recherche expérimentale juridiquement délimitée soumise à une réglementation spécifique

   ( ) Un ensemble constitué par une zone non délimitée autour de l'aire centrale et d'une ou plusieurs zones délimitées de recherche expérimentale ou de gestion (réserve de la biosphère en groupement)

   ( ) Une zone non délimitée à activité humaine réduite

   ( ) La zone tampon manque actuellement (c-à-d: il existe seulement une aire centrale)

   ( ) Autre situation (Prière de préciser)_____

   _____

2. Une zone de transition entoure normalement la zone tampon délimitée. Dans cette zone généralement non délimitée qui constitue la zone d'influence de la Réserve de la Biosphère, un certain nombre d'utilisations et d'activités peuvent avoir lieu ou être permises. Veuillez COCHER sur la liste suivante les activités qui s'appliquent à la zone de transition de votre Réserve de la Biosphère, ou qui ont lieu à l'extérieur de la Réserve de la Biosphère, mais à quelques kilomètres seulement des limites de l'aire centrale, de la zone tampon et des zones de recherche. ENTOURER alors un chiffre qui indique l'importance de cette utilisation ou de cette activité pour la région. ENTOURER le nombre 5 signifie que l'utilisation ou l'activité est dominante ou très notable et qu'elle a un effet important sur la valeur de la Réserve de la Biosphère pour la conservation et la recherche. ENTOURER le chiffre 1 signifie que l'utilisation ou l'activité est mineure et n'a pas d'effet sur la valeur de la Réserve de la Biosphère pour la conservation et la recherche.

Ces utilisations et ces activités se présentent dans la zone de transition ou à quelques kilomètres des zones délimitées: (Cocher celles qui se présentent)	Quelle est l'importance de cette utilisation ou de cette activité?
( ) activités agricoles	5 4 3 2 1
( ) projets agroforestiers	5 4 3 2 1
( ) pêche et ramassage de coquillages	5 4 3 2 1
( ) dragage/remblayage	5 4 3 2 1
( ) pâturage	5 4 3 2 1
( ) établissements humains	5 4 3 2 1
( ) chasse	5 4 3 2 1
( ) développement industriel	5 4 3 2 1
( ) conversion des terres	5 4 3 2 1
( ) produits marins/aquaculture	5 4 3 2 1
( ) exploitation de charbon ou de minerais	5 4 3 2 1
( ) exploitation de pétrole et de gaz	5 4 3 2 1
( ) braconnage	5 4 3 2 1
( ) activités de loisirs	5 4 3 2 1
( ) développement résidentiel	5 4 3 2 1
( ) stabilisation du rivage	5 4 3 2 1
( ) activités de subsistence	5 4 3 2 1
( ) production de bois	5 4 3 2 1
( ) développement touristique	5 4 3 2 1
( ) infrastructures de transport	5 4 3 2 1
( ) centres urbains	5 4 3 2 1
( ) projets hydrauliques	5 4 3 2 1
Autres usages et activités (Veuillez préciser)	
( ) _____	5 4 3 2 1
( ) _____	5 4 3 2 1
( ) _____	5 4 3 2 1

Si vous avez coché "activités agricoles", veuillez indiquer les cultures pratiquées actuellement.

_____

_____

Si vous avez coché "pâturage", veuillez indiquer les types d'animaux domestiques ou d'espèces sauvages exploités actuellement.

_____

_____

Utilisez l'espace ci-dessous pour toute information supplémentaire.

_____

_____

_____

D. GESTION ET ADMINISTRATION

En raison de ses fonctions multiples, la Réserve de la Biosphère doit normalement faire l'objet de dispositions particulières pour sa gestion et son administration.

1. Un certain nombre d'énoncés concernant la gestion sur place de votre Réserve de la Biosphère sont énumérés ci-dessous. Veuillez COCHEZ les énoncés applicables.

   ( ) une autorité de gestion existe sur place et met en oeuvre un plan de gestion qui tient spécialement compte des objectifs du Plan d'Action pour les Réserves de la Biosphère

   ( ) une autorité de gestion existe sur place mais n'a pas encore établi de plan de gestion pour la Réserve de la Biosphère

   ( ) un organe de gestion sur place sera établi dans le proche avenir

   ( ) il n'est pas prévu d'organe de gestion locale

2. L'autorité de gestion sur place est normalement en liaison avec d'autres organismes de façon à développer pleinement les fonctions de la Réserve de la Biosphère. Veuillez COCHER les cas qui s'appliquent à votre Réserve de la Biosphère:

   ( ) le Comité national du MAB de votre pays

   ( ) les autorités administratives responsables de la planification et du développement de la région

   ( ) la communauté locale et les représentants de la population vivant à l'intérieur ou autour de la Réserve de la Biosphère

   ( ) des institutions scientifiques engagées dans la recherche fondamentale ou appliquée ou la surveillance continue relatives aux ressources naturelles

   ( ) jardins botaniques et zoologiques nationaux ou étrangers

   ( ) autorités de gestion d'autres Réserves de la Biosphère dans votre pays

   ( ) autorités de gestion de Réserves de la Biosphère dans d'autres pays

3. Il est important que les visiteurs et la population locale soient informés que la région a statut de Réserve de la Biosphère. Veuillez COCHER les mesures prises pour permettre de reconnaître ce statut:

   ( ) Cérémonie d'inauguration
   ( ) Signalisation à l'entrée ou plaque

( ) Etablissement d'une station de recherche sur place
( ) Brochure ou matériel audio-visuel
Autres actions (veuillez préciser)
( ) _____
( ) Pas de mesures de reconnaissance, mais elles sont prévues
( ) Pas de mesures de reconnaissance prévues

4. Les Réserves de la Biosphère ont besoin d'un appui technique et financier pour leur propre gestion et pour se consacrer aux problèmes interdépendants de l'environnement, de l'utilisation des terres et du développement socio-économique. Veuillez COCHER les énoncés de la liste ci-dessous qui s'appliquent à votre Réserve de la Biosphère.

( ) Les activités reçoivent un appui de diverses sources nationales y compris d'une autorité administrative centrale

( ) Les activités reçoivent un appui d'une seule autorité administrative centrale

( ) Les activités reçoivent un appui seulement de l'autorité administrative locale

( ) Les activités reçoivent une assistance spéciale de la population locale. Veuillez préciser: _____

( ) Les activités reçoivent un appui de sources internationale. Veuillez énumérer ces sources internationales (Unesco, UNEP, FAO, UICN, WWF, etc...) et les projets qu'elles appuient: _____

_____

_____

E. POPULATION LOCALE ET PARTICIPATION

1. La population locale vivant à l'intérieur et autour de la Réserve de la Biosphère répond au qualificatif suivant (Veuillez COCHER):

( ) Agricole
( ) Pêche artisanale et ramassage de coquillages
( ) Chasse-cueillette
( ) Nomade
( ) Pastorale
( ) Urbaine ou suburbaine
Autre (veuillez préciser):
( ) _____

2. Si des populations indigènes vivent à l'intérieur ou à proximité de la Réserve de la Biosphère, veuillez donner ci-dessous une brève description de ces populations:

_____

3. Combien approximativement de personnes vivent en permanence dans la zone tampon? _____

4. Les Réserves de la Biosphère doivent normalement apporter des avantages à la population vivant à l'intérieur ou autour d'elles.

La liste ci-dessous énumère un certain nombre d'avantages potentiels. Veuillez COCHER à gauche chaque type d'avantage applicable à votre Réserve de la Biosphère. Veuillez ensuite COCHER dans l'une des colonnes de droite si ces avantages liés à la Réserve de la Biosphère sont majeurs ou mineurs. Un avantage majeur est celui qui a des retombées économiques substantielles ou qui est lié à une amélioration notable du bien être de la majeure partie de la population locale. Un avantage mineur correspond à une retombée économique réduite ou à une amélioration du bien être d'une petite partie de la population.

		Avantage majeur	Avantage mineur
( )	possibilités d'emploi	( )	( )
( )	possibilités d'éducation et de formation	( )	( )
( )	encouragements et profits financiers	( )	( )
( )	services sanitaires et sociaux	( )	( )
( )	assistance au développement rural	( )	( )
( )	possibilités de tourisme et de loisirs	( )	( )
( )	conservation des sols et des eaux	( )	( )
( )	maintien de la culture et des coutumes traditionnelles	( )	( )
( )	participation à la planification et à la gestion de la Réserve de la Biosphère	( )	( )
( )	Autres avantages (Prière de préciser) _____	( )	( )
( )	Il n'y a pratiquement pas d'avantages pour la population locale		

F. CONSERVATION

Les Réserves de la Biosphère peuvent servir une large gamme d'objectifs de conservation.

Veuillez COCHER tous les objectifs suivants qui s'appliquent particulièrement dans le cas de votre Réserve de la Biosphère.

( ) Conserver une zone écologique représentative à l'état naturel ou très peu perturbé

( ) Conserver des écosystèmes azonaux et des zones intermédiaires (terres humides, zones côtières, etc...)

( ) Conserver de grands prédateurs

( ) Conserver de grands herbivores

( ) Conserver des espèces animales ou végétales menacées inscrites au "Livre Rouge"*

( ) Conserver des espèces ou sous-espèces menacées à l'échelon national ou régional

( ) Conserver des espèces sauvages apparentées aux espèces importantes économiquement*

( ) Conserver des variétés d'animaux domestiques ou des cultivars agricoles traditionnels dans le cadre des systèmes de production locaux*

( ) Conserver un paysage harmonieux résultant de l'application de pratiques traditionnelles d'utilisation des terres

( ) Conserver la diversité biologique dans des écosystèmes aménagés

( ) Réintroduire des espèces indigènes dans des zones où elles ont disparu

Autres objectifs. Veuillez préciser:

( ) _____

( ) _____

* Au cas où elle serait facilement disponible, VEUILLEZ JOINDRE UNE LISTE DE CES ESPECES

G. RECHERCHE ET SURVEILLANCE CONTINUE

1. Le développement d'un programme intégré de surveillance continue et de recherche constitue l'une des fonctions principales des Réserves de la Biosphère. COCHEZ tous les énoncés ci-dessous qui s'appliquent à votre Réserve de la Biosphère.

( ) La Réserve de la Biosphère a un programme intégré de recherche fondamentale et appliquée qui concourt aux objectifs de gestion du site et à une conservation durable dans la région.

( ) La Réserve de la Biosphère a un programme de recherche fondamentale qui n'est pas orienté vers les questions d'utilisation et de gestion des terres

( ) La Réserve de la Biosphère a un programme de recherche appliquée orienté vers les questions d'utilisation et de gestion des terres

( ) La Réserve de la Biosphère participe à des travaux de surveillance continue ou de recherche comparative avec une autre Réserve de la Biosphère ou site de recherche dans la même province biogéographique*

( ) La Réserve de la Biosphère participe à des travaux de surveillance continue ou de recherche comparative avec une autre Réserve de la Biosphère ou site de recherche dans une autre province biogéographique*

( ) La Réserve de la Biosphère est le siège d'un Projet MAB Unesco*

( ) La Réserve de la Biosphère est utilisée pour la recherche de façon occasionnelle mais n'a pas de programme permanent de surveillance continue et de recherche

( ) La Réserve de la Biosphère n'a pas fait l'objet de recherches dans le passé et n'a pas de programme de recherche et de surveillance

Approximativement combien de scientifiques nationaux ont-ils participé à des recherches sur place au cours de l'année passée? _____

Approximativement combien de scientifiques étrangers ont-ils participé à des recherches sur place au cours de l'année passée? _____

* Veuillez indiquer le sujet des recherches et, le cas échéant, le nom de la réserve ou du site avec lequel une coopération est engagée.

_____

_____

_____

_____

2. Les activités de recherche peuvent être liées à diverses fonctions de la Réserve de la Biosphère y compris notamment la mise en valeur durable des ressources des écosystèmes. Les priorités et l'état des recherches varient d'un cas à l'autre.

Veuillez indiquer la situation pour chacun des sujets de recherche ci-dessous en COCHANT la ou les colonnes appropriées pour indiquer si une recherche est en cours ou prévue dans le cadre du programme établi pour votre Réserve de la Biosphère au cours des cinq prochaines années.

	Activité en cours	Activité prévue
dépôts acides	( )	( )
recherche agronomique	( )	( )
technologie rurale appropriée	( )	( )
enquête et collection biologique	( )	( )
cycle biogéochimique	( )	( )
recherche écologique comparative	( )	( )
anthropologie culturelle	( )	( )
succession écologique	( )	( )
modélisation des écosystèmes	( )	( )
restauration des écosystèmes	( )	( )
effets des polluants atmosphériques	( )	( )
effets des polluants sur l'eau	( )	( )
effets des pesticides	( )	( )
ethnobiologie	( )	( )
espèces exotiques	( )	( )
histoire et effets du feu	( )	( )
recherche forestière	( )	( )
gestion des ressources génétiques	( )	( )
cycle hydrologique	( )	( )
limnologie et hydrobiologie	( )	( )
remise en état d'exploitations minières	( )	( )
pestes et maladies	( )	( )

gestion des terrains de parcours	( )	( )
espèces rares ou menacées	( )	( )
effets du tourisme et des loisirs	( )	( )
cartographie des ressources	( )	( )
sédimentation	( )	( )
étude et conservation des sols	( )	( )
systèmes traditionnels d'utilisation des terres	( )	( )
aménagement des bassins versants	( )	( )
dynamique des populations d'espèces sauvages	( )	( )
Autre sujet. Veuillez préciser		
_____	( )	( )
_____	( )	( )

H. EDUCATION ET FORMATION

Veuillez indiquer la situation de chacune des activités énumérées ci-dessous en COCHANT la ou les colonnes appropriées selon que l'activité est en cours ou prévue au cours des cinq prochaines années ou les deux. COCHEZ la dernière colonne si l'activité concernée n'a pas lieu.

	Activité en cours	Activité prévue	Pas d'activité
Education relative à l'environnement pour les écoliers et les étudiants	( )	( )	( )
Services de vulgarisation pour la population locale	( )	( )	( )
Projets de démonstration relatifs à l'utilisation et à la gestion des terres	( )	( )	( )
Projets de recherche pour étudiants au niveau universitaire et post-universitaire	( )	( )	( )
Programmes d'information des touristes	( )	( )	( )
Formation professionnelle et ateliers pour scientifiques	( )	( )	( )
Formation professionnelle et ateliers pour gestionnaires des ressources et aménageurs du territoire	( )	( )	( )
Formation de personnel pour la gestion des Réserves de la Biosphère	( )	( )	( )
Formation du personnel local sur la notion et la gestion des Réserves de la Biosphère	( )	( )	( )
Autres activités. Veuillez préciser			
_____	( )	( )	
_____	( )	( )	

I. PERSONNEL ET INSTALLATIONS SUR PLACE

Sur la liste ci-dessous, COCHEZ les cas qui s'appliquent à l'intérieur de votre Réserve de la Biosphère.

( ) Station de surveillance continue de la pollution de l'air

( ) Station climatologique pour surveillance continue

( ) Installations pour conférences ou réunions

( ) Station hydrologique pour surveillance continue

( ) Installations de laboratoire

( ) Bibliothèque

( ) Logements pour scientifiques de passage. Combien? _____

( ) Micro-ordinateurs. Marque/modèle_____

Autres ordinateurs. Marque/modèle_____

( ) Parcelles permanentes de surveillance. Combien? Végétation_____

Lac/cours d'eau _____ Biocénoses marines benthiques _____

Autres parcelles (veuillez préciser)_____

( ) Routes d'accès aux sites de recherche

( ) Sites de recherche intégrée sur petits bassins versants. Combien? _____

( ) Installations pour l'emmagasinage et la conservation des collections biologiques

( ) Personnel de recherche permanent sur place. Combien? _____

Personnel de niveau universitaire _____ Techniciens _____

( ) Personnel administratif sur place (tout le personnel sauf le personnel de recherche). Combien? Personnel de niveau universitaire _____ Autres _____

( ) Personnel de protection sur place (gardes, etc...). Combien? _____

J. INFORMATION DE BASE SUR LES RESSOURCES

COCHEZ sur la liste ci-dessous les types d'information disponibles pour la Réserve de la Biosphère. Pour certains d'entres eux, pouvez-vous estimer le nombre d'années pendant lequel ce type d'information a été enregistré.

( ) photographies aériennes (_____ ans)

( ) données relatives aux dépôts acides (_____ ans)

( ) données relatives à la qualité de l'air (_____ ans)

( ) écosystèmes aquatiques d'eau douce (_____ ans)

( ) écosystèmes aquatiques marins (_____ ans)

( ) bibliographie

( ) données climatologiques (_____ ans)

( ) informations ethnobiologiques

( ) carte géologique

( ) relevé historique des études scientifiques

( ) données hydrologiques de surface (_____ ans)

( ) données hydrologiques souterraines (_____ ans)

( ) inventaire des mammifères (_____ ans)

( ) inventaire des autres vertébrés (_____ ans)

( ) inventaire des invertébrés (_____ ans)

( ) inventaire des plantes vasculaires (_____ ans)

( ) inventaire des plantes non-vasculaires (_____ ans)

( ) histoire de l'utilisation des terres (_____ ans)

( ) carte de l'utilisation des terres

( ) carte et description des sols

( ) carte topographique

( ) carte de végétation

( ) données relatives à la végétation (_____ ans)

( ) données relatives à la qualité de l'eau (_____ ans)

( ) autres informations et données de base (veuillez préciser):

_____

_____

_____

K. REPONDANT

Nom du Répondant: _____

Fonction: _____

Adresse: _____

_____

_____

Téléphone: _____

Principal diplome académique: _____

Antécédents professionnels: _____

_____

Nombre d'années d'association à la Réserve de la Biosphère: _____

ADRESSE POSTALE POUR INFORMATIONS SUPPLEMENTAIRES SUR LA RESERVE DE LA BIOSPHERE (si elle diffère de celle du répondant)

Nom: _____

Fonction: _____ _____

Adresse: _____

_____

Téléphone: _____

Nous vous remercions pour le temps et le travail que vous avez consacré à remplir ce questionnaire. Veuillez retourner le questionnaire aussitôt que possible de façon à ce qu'il parvienne au Secrétariat du MAB de préférence avant le 31 juillet 1986. Les résultats de notre analyse devraient offrir une vision claire de l'état actuel du réseau international de Réserves de la Biosphère et pourrait vous fournir des idées et des suggestions à partir de l'expérience acquise dans d'autres parties du monde.

Si vous désirez un exemplaire des résultats de notre analyse, veuillez cocher ci-dessous.

( )

A stylized 'ankh', the ancient Egyptian sign for life, has been incorporated into the symbol of the Programme on Man and the Biosphere (MAB)

Une stylisation du 'ankh' signe de la vie dans l'ancienne Egypte, a été introduite dans le sigle du Programme sur l'homme et la biosphère (MAB)

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